

THE IRON AGE

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Minnesota Steel Company Completes Plant

A Detailed Description of Construction,
Layout and Operation—Mill Featured
by Electric Drive and Massive Design

The general facts regarding the location of a steel works subsidiary of the United States Steel Corporation at Duluth, the reasons that led to it, its advantages and lack of them, and the nature of the units provided, have already been described, particularly in THE IRON AGE of Sept. 18, 1913. The present article is accordingly confined to a description of the construction features of the plant itself. The accompanying illustrations and drawings present a number of details to which it has therefore been thought unnecessary to refer, by way of repetition, in the text. A considerable portion of the descriptive information that could be expressed numerically will be found in the accompanying tables. Briefly, the plant comprises coke ovens with a daily capacity of 1000 tons; a by-product recovery plant; two blast furnaces rated at 500 tons each; a gas-engine-driven blower and electric generating station; an open-hearth plant providing for ten 75-ton furnaces, of which seven are completed; a combination rail, structural, billet and bar mill, and a merchant mill. The entire works have an estimated annual capacity of

blast furnace at the extremely low winter temperatures and the flexibility of the rail and structural mill in producing economically the variety of products for the rolling of which it is designed.

THE COKE OVEN PLANT

The coke oven installation does not depart in any radical way from the standard Koppers construction, except that the battery is made up of the unusually large number of ninety ovens. The practice at this plant is to be very similar to the oven operation at the Illinois Steel Company's Gary works. The general location of the ovens with respect to the coal-handling plant, which apparatus was supplied by the Robins Conveying Belt Company, is shown in view reproduced on the supplemental chart, and the layout is indicated in the accompanying bird's-eye view.

The coal is received from bottom dump cars in two duplex track hoppers, whence it is fed by automatic feeders and carried underground by belt conveyor to the breaker building, in which it is elevated for gravity charging into the Bradford breakers. Belt conveyors then elevate the crushed

Plant Summary

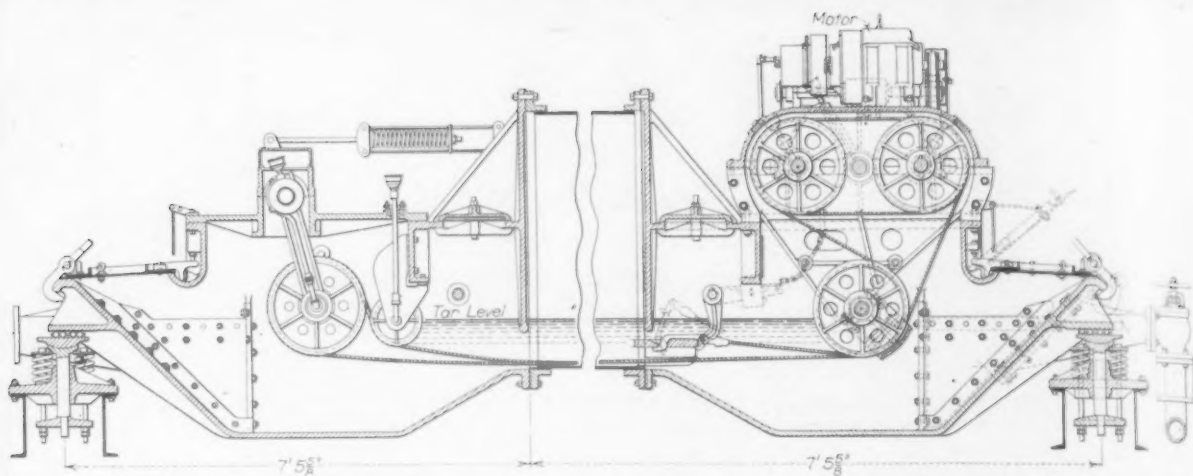
Duluth Works, Minnesota Steel Company

No. of coke ovens.....	90 in one battery.
Aggregate capacity per day.....	1000 tons.
No. of blast furnaces.....	Two 20 ft. 6 in. x 89 ft.
Combined capacity per day.....	1000 tons.
No. of stoves per furnace.....	Five.
Gas washers.....	Grid spray primary, Ernst secondary.
No. of open hearths.....	Ten, seven completed.
Rated capacity.....	75 tons.
Ladle capacity.....	100 tons.
Waste heat boilers.....	400 hp., one for each furnace.
Ingot mold size.....	22 x 26 x 77 in.
Soaking pit capacity.....	96 ingots.
Blooming mill.....	2-high, 40-in. reversing.
No. of passes of ingot in blooming mill	11 to 15, or more if desired.
Regular section of bloom.....	8 x 8 in.
Blooms reheated.....	Yes.
Reheating furnaces.....	3 16-ft. continuous, regenerative type.
No. of passes on rail mill.....	10.
Power plant.....	4 twin-tandem 3000 kw.
Air blast plant.....	5 24,000-cu. ft. each.
Total estimated capacity of plant..	350,000 tons.

350,000 tons of semi-finished and finished steel products. The first iron was produced on Dec. 1 and the first steel on Dec. 13.

The distinctive characteristics of the plant are the massiveness of its construction throughout and the details which have been incorporated as precautionary measures against the severe weather conditions of the winter at Duluth. The two principal problems in connection with which new experiences are likely to be encountered are the operation of the

coal to the 150-ton storage bins over the two Williams pulverizers or hammer mills, from which stage it is again conveyed to a four 250-ton compartment mixer. The two kinds of coal, Pittsburgh and Pocahontas, measured from the mixer in proper proportions, are conveyed across to a 2100-ton storage tower that surmounts one end of the oven battery. Provision is made for a second set of track hoppers and a second breaker, while the conveyor arrangement features an exceptional flexibility in providing



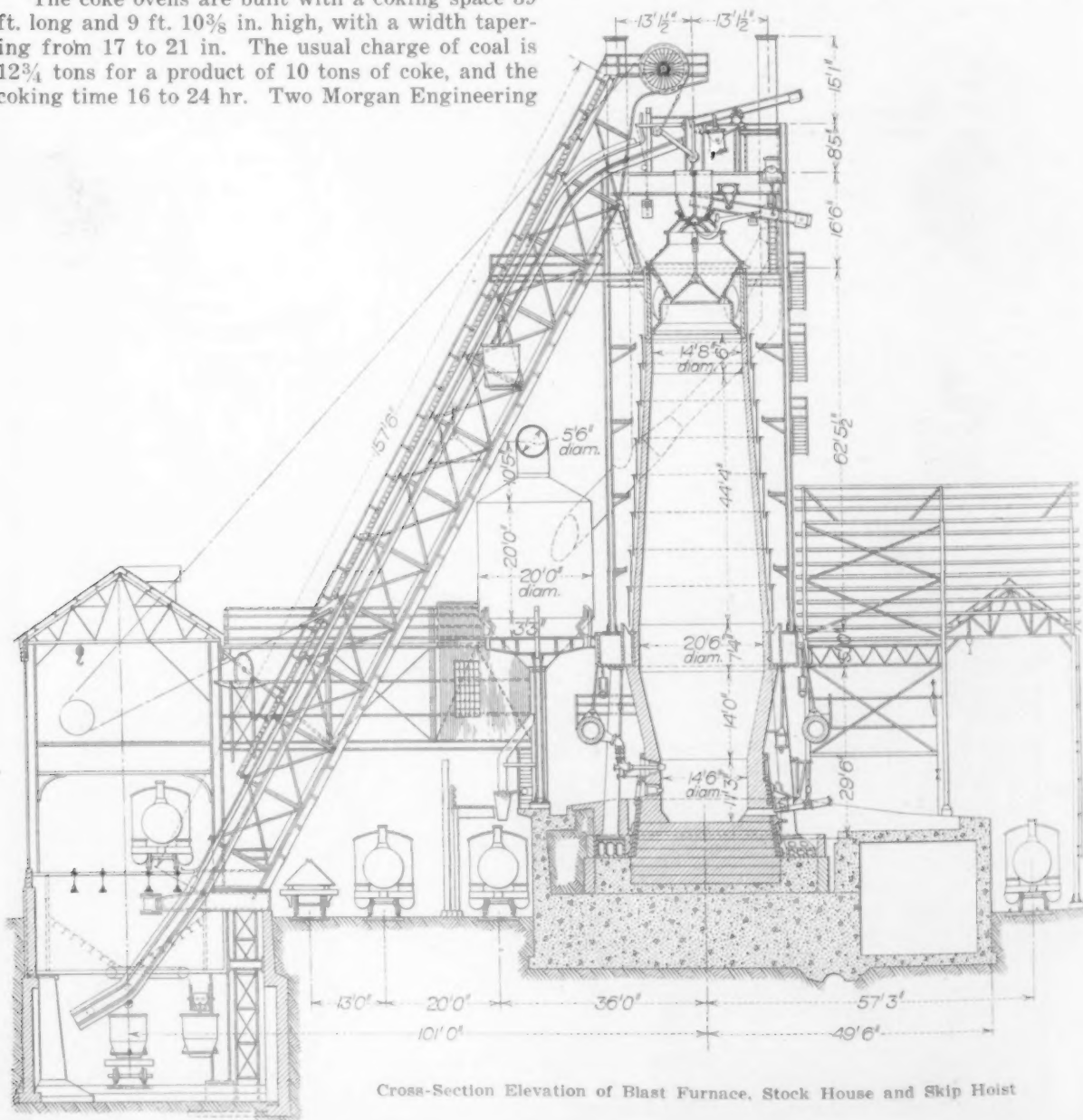
To Keep the Pitch Trough of the Coke-Oven Plant Clean a Wooden Boat Is Drawn Through It by Means of an Electrically Driven Cable

for the handling of crushed coal from either breaker to any hammer mill. The two 4-pocket coke larries for charging the ovens, are of the usual electrically operated type, except for the fact that the larry operation may be controlled from either end. This permits the operator to run the larry from the end where wind-blown smoke does not obscure his view along the ovens, the operator's position permitting him to see ahead of the larry.

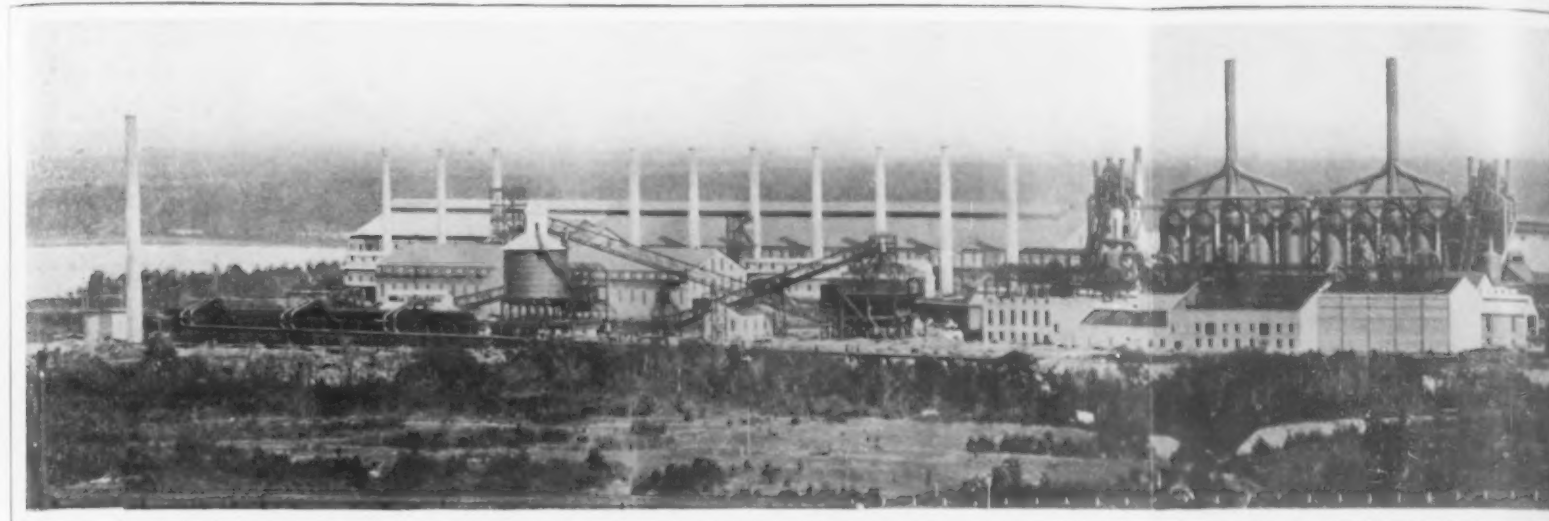
The coke ovens are built with a coking space 39 ft. long and 9 ft. 10 $\frac{3}{8}$ in. high, with a width tapering from 17 to 21 in. The usual charge of coal is 12 $\frac{3}{4}$ tons for a product of 10 tons of coke, and the coking time 16 to 24 hr. Two Morgan Engineering

Company electrically-operated pushers and levelers serve the battery and on the pusher side mount the oven doors. On the coke side the door-mounting machine is suspended from an overhead crane, which also serves to carry the clay in 800-lb. boxes for luting the doors.

From the pitch trough there are three gas take-offs to the gas main, which extends above ground with a continuous incline to its lowest point in a pit



Cross-Section Elevation of Blast Furnace, Stock House and Skip Hoist

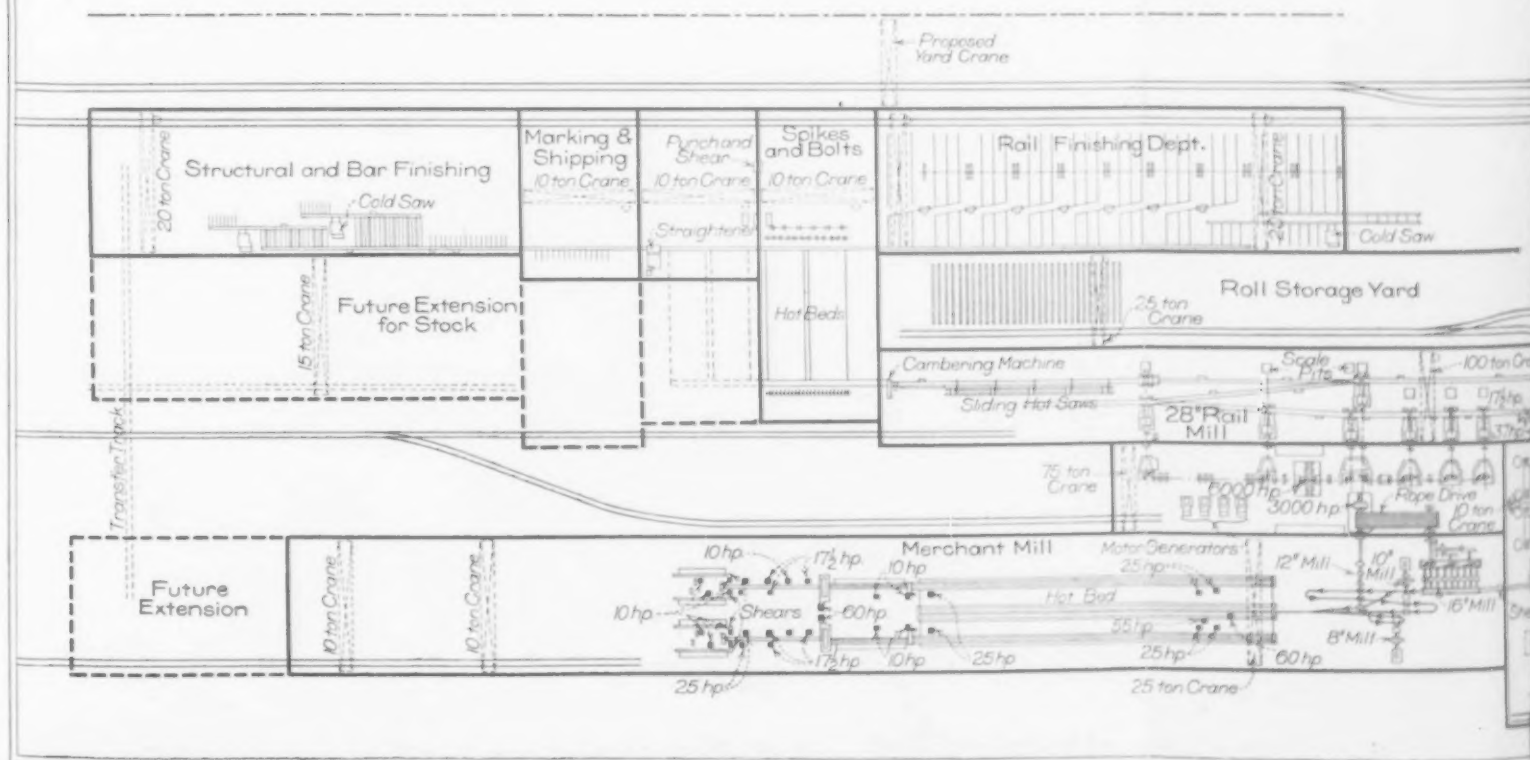


At the Left Are the Coke Ovens; Beyond Are the Open Hearth Furnaces

MINNESOTA STEEL COMPANY

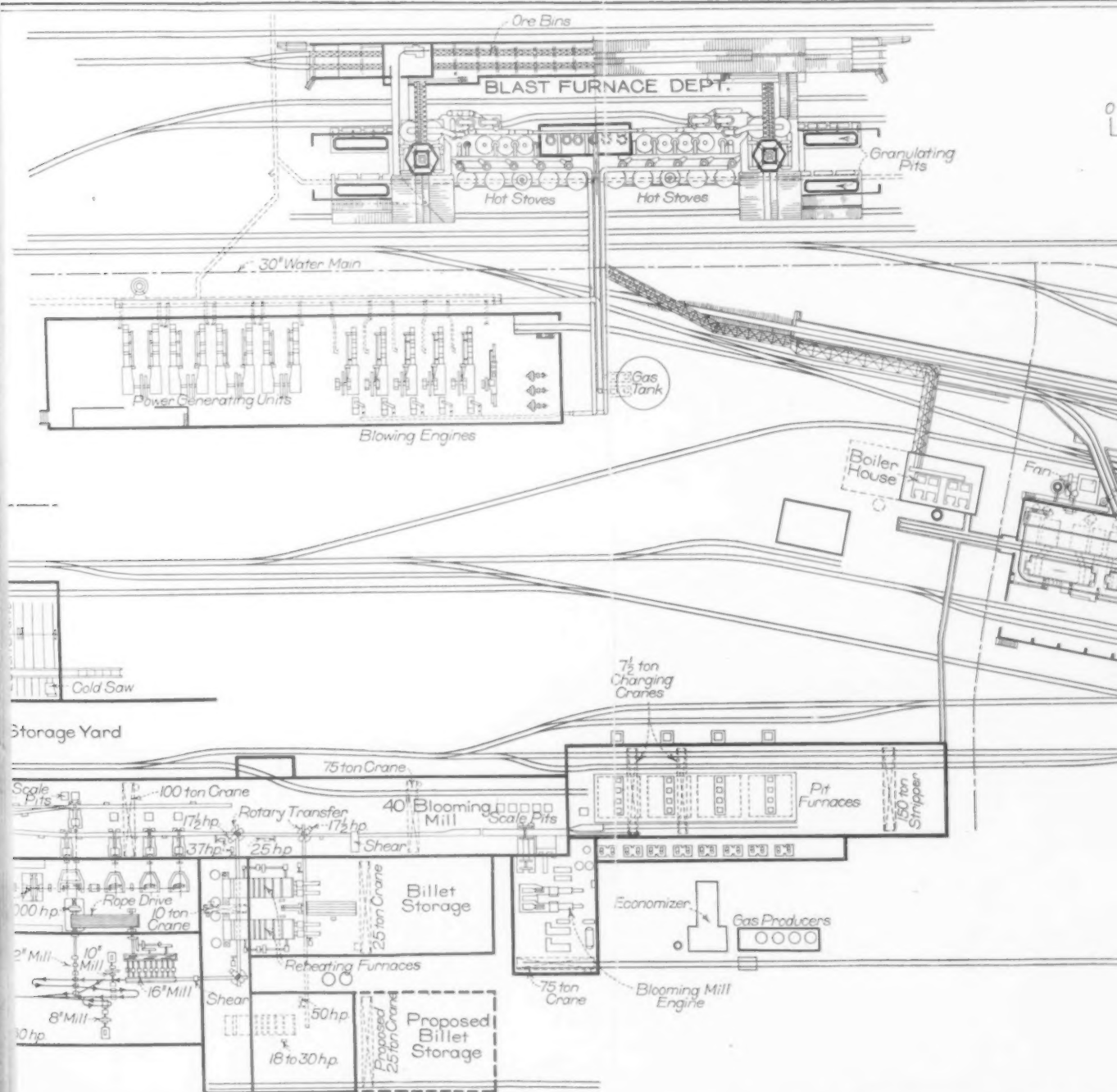
General Plan of the Duluth Plant of the United States Steel Corporation

Northeast of the Steel Plant Are Located the Works of the Universal Portland Cement Plant and Beyond Is the Town of Morgan Park, Erected for the Superintendents, Foremen and Skilled Workmen of the Two Plants



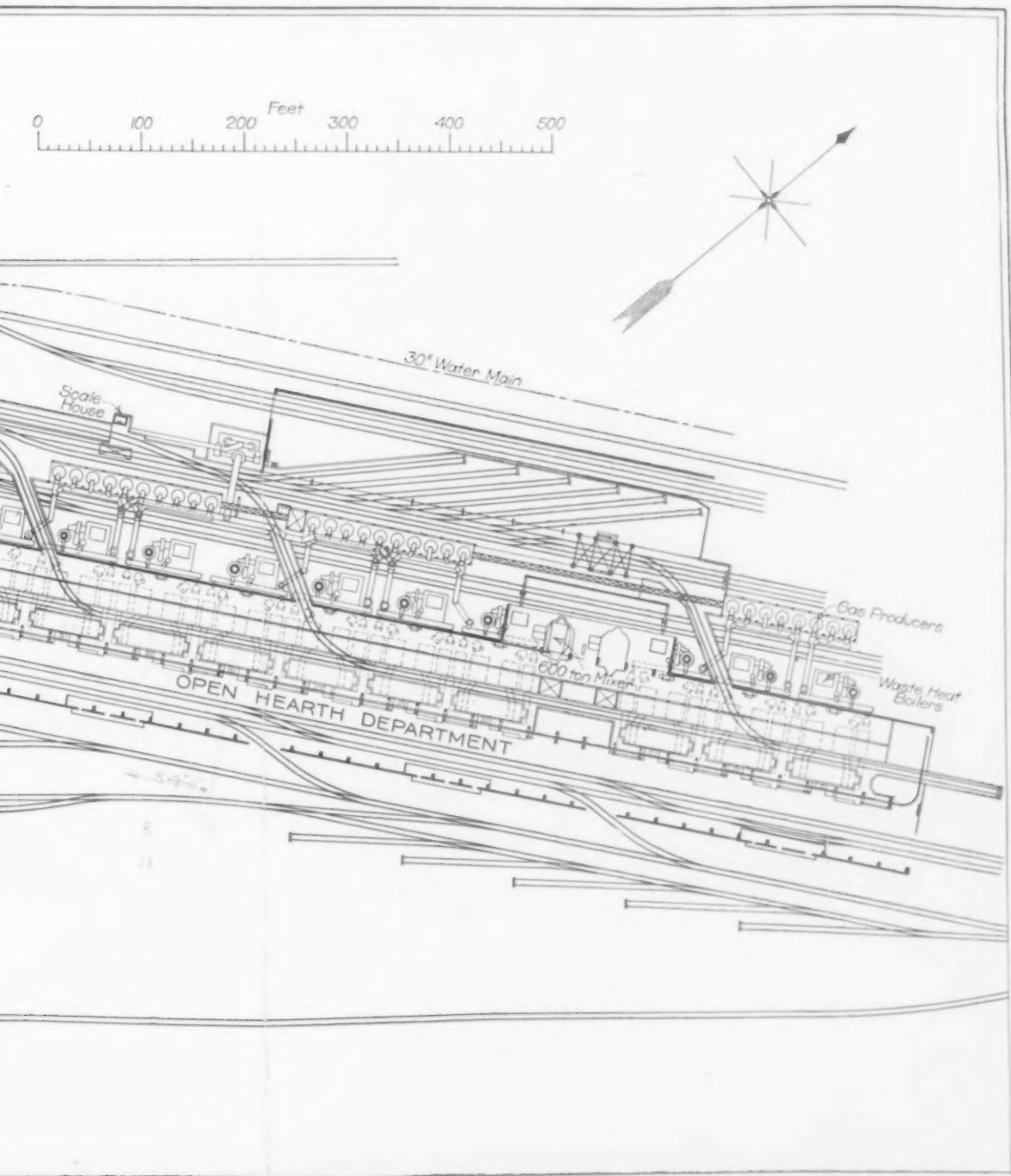


in Hearth Furnaces; Near the Center May Be Seen the Blast Furnaces, and Toward the



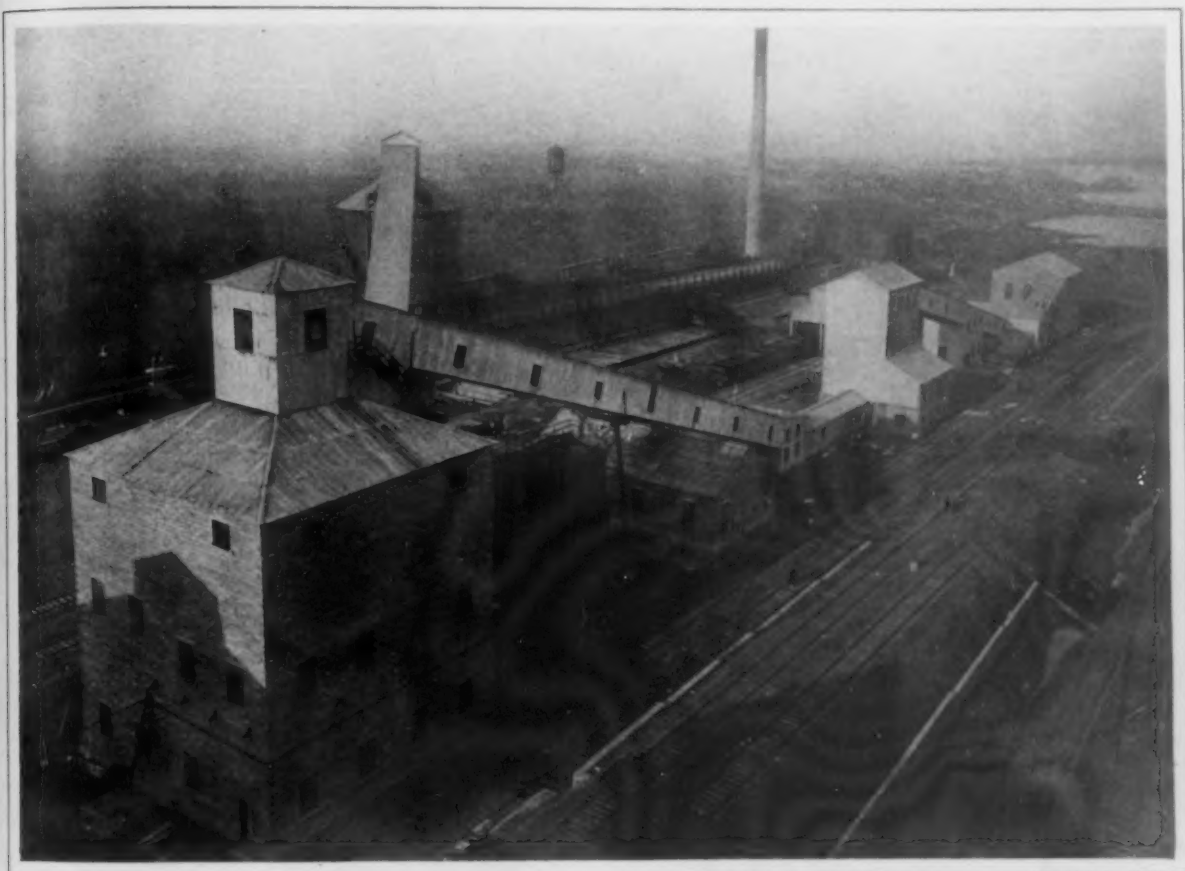


On the Right Are the Rail, Bar and Structural Mills.



directly outside of the cooler building of the by-products recovery station. Such liquids as collect in the pipe thus drain to this low point and can be removed. In the pitch trough a novel construction has been devised for keeping the trough clean, consisting of a wooden boat drawn by means of an electrically-driven sheave and cable. The excessive expansion and contraction of the pitch trough, due not only to the wide range of temperature but also to the unusual length of the ovens, made necessary a special device that would provide automatic adjustment in the form of a ball-bearing expansion support and an adjustable end casting at the driving end of the cable. Sketches of this are here shown.

28-ft. 3-in. centers. The stacks have a rated capacity of 500 tons each, are 89 ft. high and 20 ft. 6 in. at the largest inside diameter. The hearth has a diameter of 14 ft. 6 in., which gives to the boshes an inclination of $77\frac{1}{2}$ deg. The furnace shell is thin lined with a thickness of 16-in. and is water cooled with a series of eight troughs, having an aggregated water space of 2087 cu. ft., equivalent to 15,632 gal., or 130,430 lb. of water. The water space in the mantel is 805 cu. ft. The top section of the stack in which the bells are mounted is a cast-iron ring 6-in. thick, water cooled with $1\frac{1}{2}$ -in. pipe, 12 ft. high and made in eight sections. The large bell has a maximum diameter of 9 ft. The



Coal Handling and Coke Plant Viewed from the Blast Furnaces

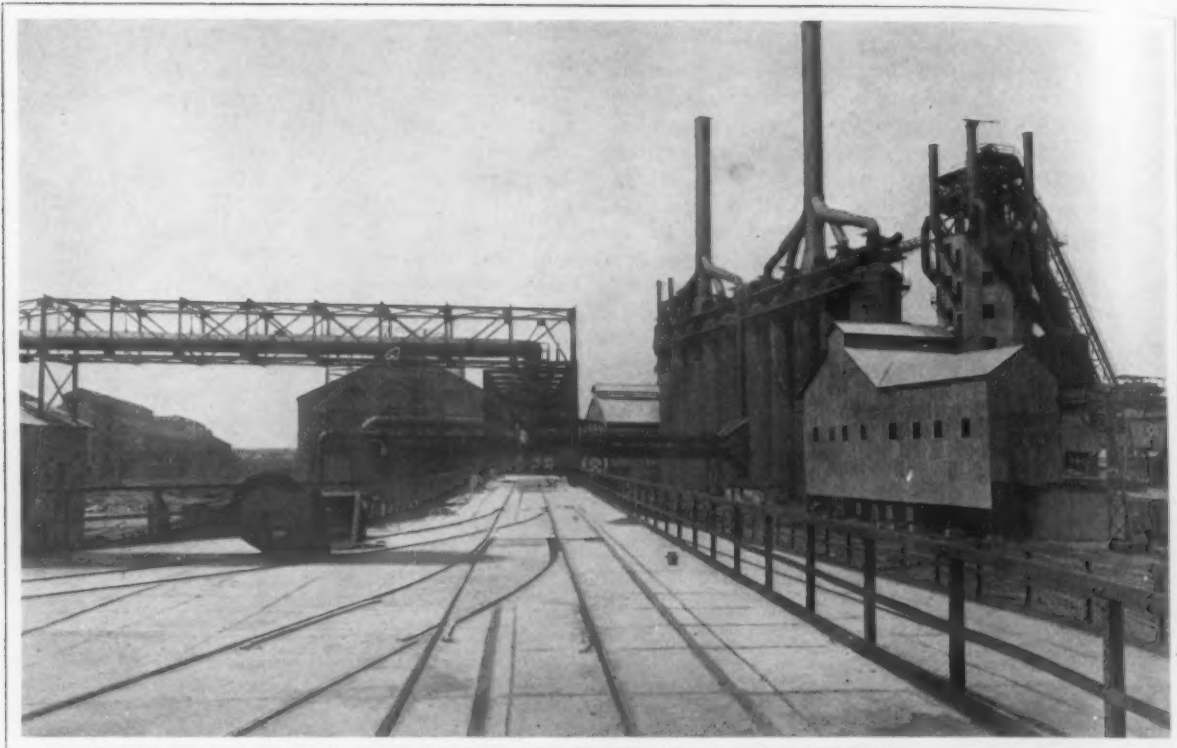
The coke screening station is erected on concrete piers on a side hill so that the entire operation is by gravity. The coke from the ovens in the quenching car drawn by an electric locomotive, after passing the quenching station continues at the same grade and dumps the coke directly upon the shaker screen. The screening station is 40 ft. 11 in. long and provides four screens, each 7 ft. $4\frac{1}{2}$ in. wide. Two separations are made, furnace and foundry coke. From the level of the track on which the quenched coke is brought to the station, the drop to the track on which the screened coke is received is 33 ft. $11\frac{1}{2}$ in. There are two screened coke receiving tracks, one 27 ft. 2 in. and the other 40 ft. 2 in. on center lines from the high level track. The screens are made adjustable as to slope so that delivery of the coke may be made to cars on either track. At the quenching station the water-controlling valve is a self-draining type to prevent freezing.

THE BLAST FURNACES

The two blast furnaces are located on 360-ft. centers with five stoves for each furnace, spaced on

furnaces have two cinder notches 120 deg. apart and 30 deg. off the center line of the furnace. For each stack there are two concrete cinder granulating pits, each of 15,000 cu. ft. capacity, one for each cinder notch and spanned by overhead crane, as shown in one of the illustrations. Each stack is carried on six cast-iron columns on a circle of 30 ft. diameter at the top and 33 ft. at the bottom. There are twelve tuyeres, two between each pair of columns.

The furnaces are equipped with the Neeland charging system and top, the latter being similar to the Duquesne furnace tops. The top of the skipway is supported on the framework which incloses the furnace, this framework serving also as a support for the corrugated sheeting within which the stack is entirely inclosed. The skipway is inclined at an angle of 61 deg. from the horizontal, and the charging buckets have a charging capacity of approximately 16,000 lb. of ore and about 11,000 lb. of limestone. They have a total cubical capacity of 197 cu. ft. The bell-operating mechanism is on top of the stack with the control in the hoist house over the stock bins. A modification of the original



General View of the Blast Furnaces and Stoves, Looking from the Approach to the Open-Hearth Department

arrangement of the bins in the stock house, which provided for a separate charging of coke from the bin into the bucket by means of a conveyor, has been modified so that the operation of charging will be under the control of a single man.

The proximity of this plant to the ore mines has obviated the occasion for storage facilities for ore and as a result has considerably simplified the arrangement of the stock house. In the summer season the plant will receive daily shipments, with enough ore on track for 24 hr., and for winter shipments, which are likely to be frozen in transit, a sweat-house is built with capacity for steaming 36-hr. supply of ore. What is true of the plant in general is true of the stock house with respect to

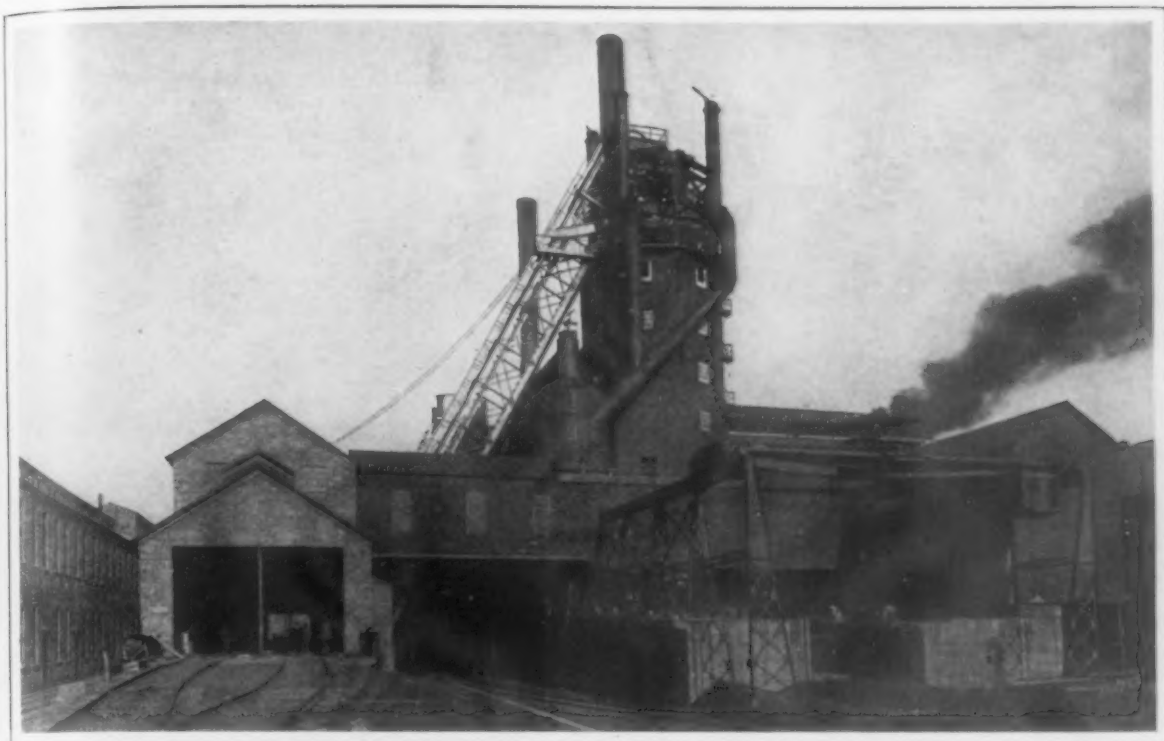
trestle approaches to building. Wherever possible excavations have been made, lowering the building elevations and yielding in many instances material for the manufacture of the cement blocks with which the mill buildings are erected. In consequence, the elevation of the top of the rails over the ore, coke and stone bins in the stock house is but 8 ft. above the tracks at yard grade, while the rails at bottom of the stock house below the bins are approximately 26 ft. 6 in. below yard grade. A cross-section of the stock house is here shown, indicating the double track arrangement for filling the bins above and below, for shifting the charging buckets for coke and stone and the several kinds of ore. Baldwin-Westinghouse electric locomotives are used for handling the cars in the stock house.

The gas from the top of the stack is taken off at four risers and brought down in two down-comers to two 20-ft. dust catchers. From the dust catchers the gas passes through 10-ft. Brassert whirlers, and then into 18-ft. grid spray primary washers. The gas for the power plant goes through a further washing process in a battery of Ernst secondary washers. All of the gas used, therefore, will be washed gas.

The probable expectancy of high hot-blast-stove efficiency appears to have been offset by the extra provisions for extreme winter temperatures in the building of five stoves for each stack. These stoves are the improved three-pass Massicks-Crooke-McClure type, 101 ft. high x 22 ft. 6 in. inside diameter and lined with a special corrugated brick yielding a total heating surface per stove of 68,000 sq. ft. The furnaces, however, were started on four stoves, and it is expected that the operation may subsequently be brought to the point of using but three stoves. The stoves were built by the Pennsylvania Engineering Works, Newcastle, Pa., and present a somewhat unique appearance on top by reason of the combination of a three-pass stove with a central stack construction for each group of five stoves. This central stack has a diameter of 9 ft. 6 in. and the individual stack connections from each stove are 5 ft. inside diameter.



The Top of the Stoves Showing the Stack Construction and in the Background the Furnace Top



The Blast Furnaces Have a Corrugated Steel Housing for Protecting the Workmen and a Crane Serves the Granulating Pits

ELECTRIC POWER AND BLOWING PLANT

The power plant contains no steam units. It consists of four Allis-Chalmers 3000-kw. gas-engine-driven generators, delivering current at 6600 volts to six sub-stations, where it is stepped down to 440-220 and 110 volts, the gas engines having a rated capacity of 4200 hp., and five Bethlehem gas-driven blowing engines, rated at 2200 hp. each, and delivering 24,000 cu. ft. of air per minute. In the aggregate the plant represents an installation of 29,000 hp.

On the basis of the following calculation, it is apparent that this plant in full operation will closely approach in its consumption of gas the entire production of the blast furnaces, less the approximate 40 per cent for heating the stoves. Each blast furnace will yield about 50,000 cu. ft. of gas per minute, or a total of 6,000,000 cu. ft. per hour for the plant, of which about 3,600,000 cu. ft. is available for the power plant. This is equivalent to 354,000,000 B.t.u. per hour. On the basis of 12,000 B.t.u. per hp.-hr. for each blowing engine and 15,000 B.t.u. per kw.-hr. for the generators, a total of 312,000,000 B.t.u. will be absorbed with the entire plant in operation. This leaves an approximate excess gas production of only 7200 cu. ft. per minute. The operation of one gas-blowing unit as a spare will add something to the margin of safety.

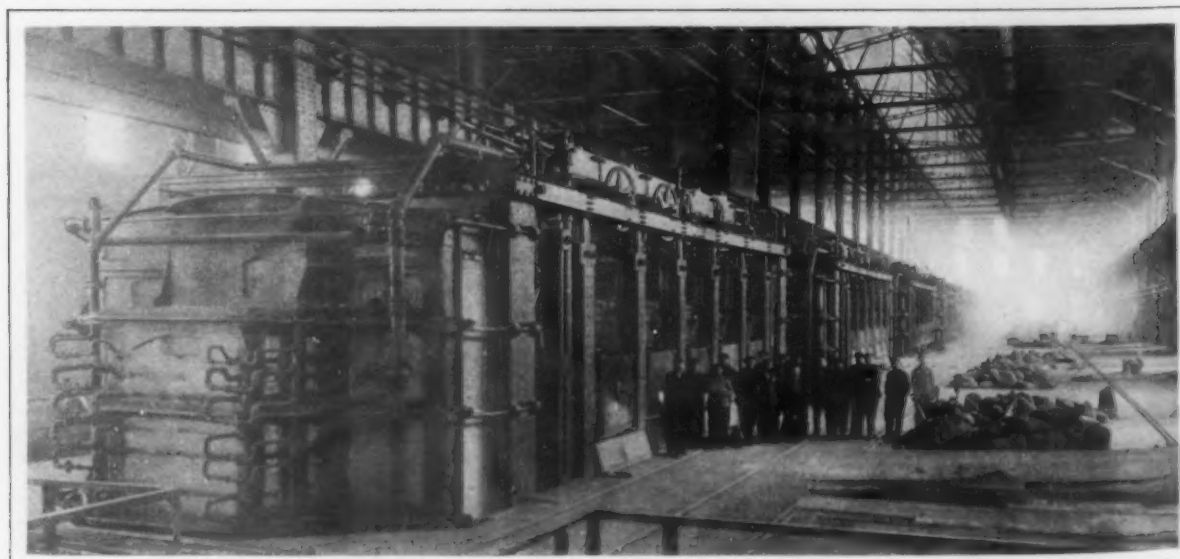
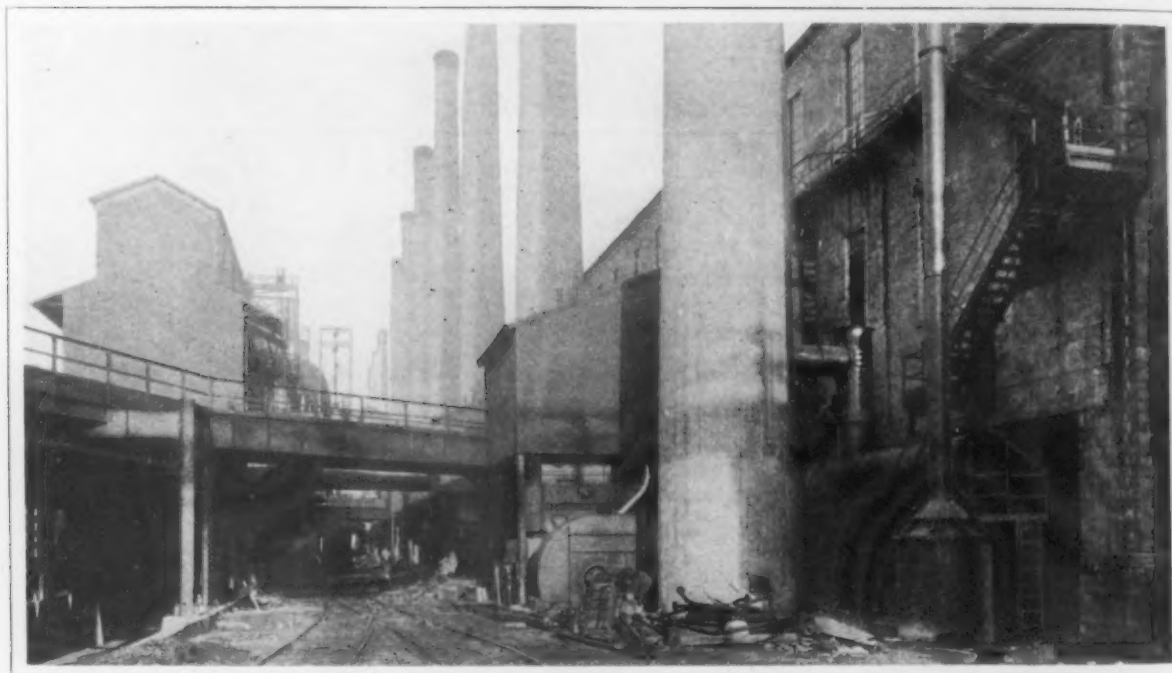
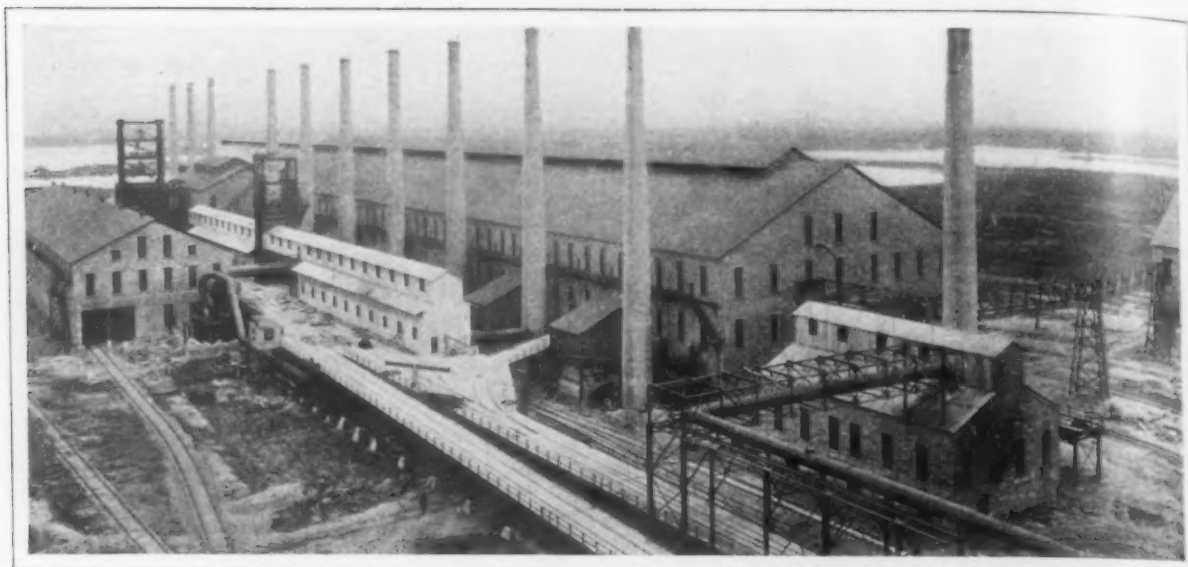
The plant was started on producer gas prior to the operation of the blast furnaces, and subsequently changed over to blast furnace gas. The only steam plant at the works other than the waste heat boilers in connection with the open-hearth is the battery of four 400-hp. coal and gas fired boilers located in a separate boiler house at the southeast end of the open-hearth building. Profiting from previous experience with respect to the excessive vibration in the building structure of gas-engine power stations, the foundations for the engine units at Duluth are completely isolated from the building itself. In the floor construction a continuous $\frac{3}{4}$ -in. gap separates the concrete piers from the concrete flooring of the building.

THE OPEN-HEARTH PLANT

The general arrangement of the open-hearth plant is shown in the supplement, and an accompanying drawing gives the cross-section. The open-hearth group consists of the main building, 984 ft. long x 141 ft. wide, the charging side bay of the building being 77 ft. 7 in. and the pouring side 63 ft. 5 in. The building provides for ten 75-ton open hearths spaced on 84-ft. centers. Of the ten furnaces seven so far have been completed. Auxiliary to the open-hearth building is the stock house on the left as one approaches from the blast furnaces, a view of which is shown among the illustrations. The gas-producer plant consists of one battery of



The Stock-house Side of the Furnaces Showing the Small Whirliers and the Grid Washers



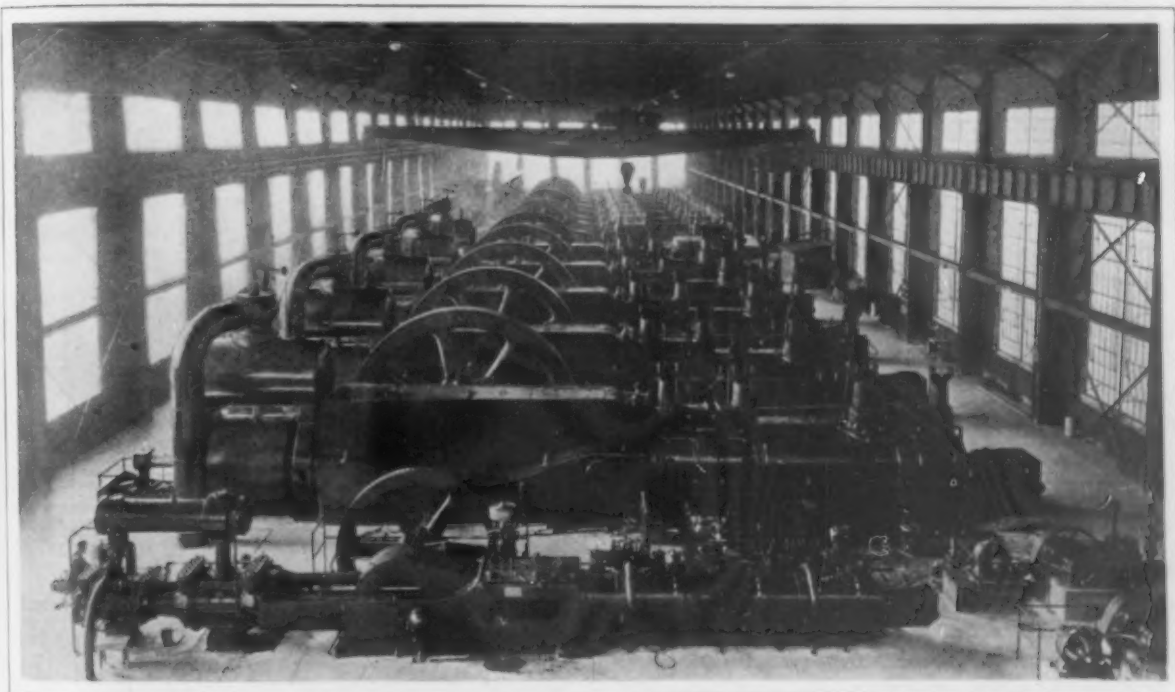
The Open-hearth Building and Approach. The stock house is at the left and the steel covered gas-producer house in the center. The waste heat boilers and fans are shown between the stacks and at the end of the open-hearth building a small boiler house for four 400-hp. gas-fired boilers. In the view of the open-hearth furnaces from the charging side are shown the circulating pipes for the Knox water cooled ports at the end of the furnace

ten producers and one of eight, with provision for the installation of an additional ten, together with the coal bin and charging facilities and a battery of 437-hp. waste-heat boilers, one for each open-hearth furnace. The mixer building is a wing on the main open-hearth building, arranged for receiving hot metal on a direct track from the blast furnaces, and houses the 600-ton mixer, with provision for its subsequent duplication.

The approach to the charging floor of the open-hearth building is a gradually ascending trestle from the hot-metal tracks of the blast-furnace plant. This approach, as indicated in the general layout, does not lead directly into the open-hearth building, but to an elevated runway off which the stock house opens directly on one side and over which are hung the ore, limestone and dolomite bins for the open-hearth supply. Below this runway are material tracks at ground level which span receiving hoppers for raw materials, from which these materials are delivered by elevators to the bins above.

hearth regenerators through overhead gas mains. The gases from the furnaces are carried through the boilers by induced draft created by a turbine-driven 60-in. Sturtevant fan, one for each boiler, and having a direct discharge into the stack. The stacks are of concrete, 6 ft. in diameter. The views indicate the location of the waste heat boilers, which are also equipped with Birkholz-Terbeck burners for the burning of coke-oven gas.

The open-hearth regenerator chambers are unusually large. Each regenerator provides 22,675 sq. ft. of air-heating surface, of which 18,851 sq. ft. is represented by checkers, and a total of 15,208 sq. ft. of gas-heating surface, of which 12,132 sq. ft. is checkers. The capacity of the checkers in the air regenerator is 5265 cu. ft. as compared with 3442 cu. ft. in the Gary regenerators; that of the checkers in the gas side is 3334.5 cu. ft. as compared with 2515 cu. ft. for the Gary installation. The gas valve from the open hearth to the waste heat boilers is 42 in. in diameter and the air valve 50 in.



The Gas-Driven Blowing Engines in the Power House, the Gas-Driven Electric Generators in the Background

The stock house, 436 ft. long and 80 ft. wide, is arranged with a platform at the open-hearth charging floor level for the storage of charging trays on tracks and also for the entrance at ground level of two raw-material tracks. The building is spanned by a 10-ton crane.

Immediately below the runway which separates the stock house from the gas-producer installation are the tracks on which also the coal for the gas producers is received. From cars on these tracks the coal is dropped into 70-ton track hoppers, which deliver it to a double-skip hoist. This hoist elevates the coal and discharges it onto a belt conveyor, which delivers it to an overhead bin with capacity of 3.4 tons per lineal foot, or approximately 56.6 tons per producer, the producers being spaced at 16-ft. 8-in. centers. The coal bin is constructed of steel plates with a 3-in. concrete lining. The producers are the Hughes mechanically-poked type and the battery is mounted above a standard-gage track, which affords facilities for the removal of the ashes. In addition to the novel arrangement for the handling of coal to the producers there is an additional feature in the carrying of the gas to the open-

The hearth of the open-hearth furnaces is 40 ft. long and 16-ft. wide, with a height of 9 ft. 11 in. from bottom to back. The back, which is 12 in. thick, is arched on a 24-ft. radius and the width of the combustion port is 4 ft. The supporting structure of the furnace is exceedingly heavy, as is clearly indicated both in the accompanying cross-section sketch and in the general view in the open-hearth building. The furnaces are equipped with Knox water-cooled ports and doors, the latter being electrically operated. For charging the furnaces a Morgan low-type machine is installed. The arrangement of the furnaces is conspicuous for the liberal allowance for passageway on all sides of the furnace, particularly around the columns on the pouring side. The charging side of the open-hearth building is spanned by 100-ton cranes and the pouring side by 150-ton cranes. The mixer building is served by a 75-ton crane.

THE ROLLING MILLS

On the pouring side of the open-hearth plant three platforms are provided for pouring the ingots, and from each of these there is a run-out track

7½-ton Morgan charging cranes. The battery of gas producers for these furnaces is located in an adjoining building, the gas being pre-heated by means of an economizer through which the waste heat from the furnaces exhausts.

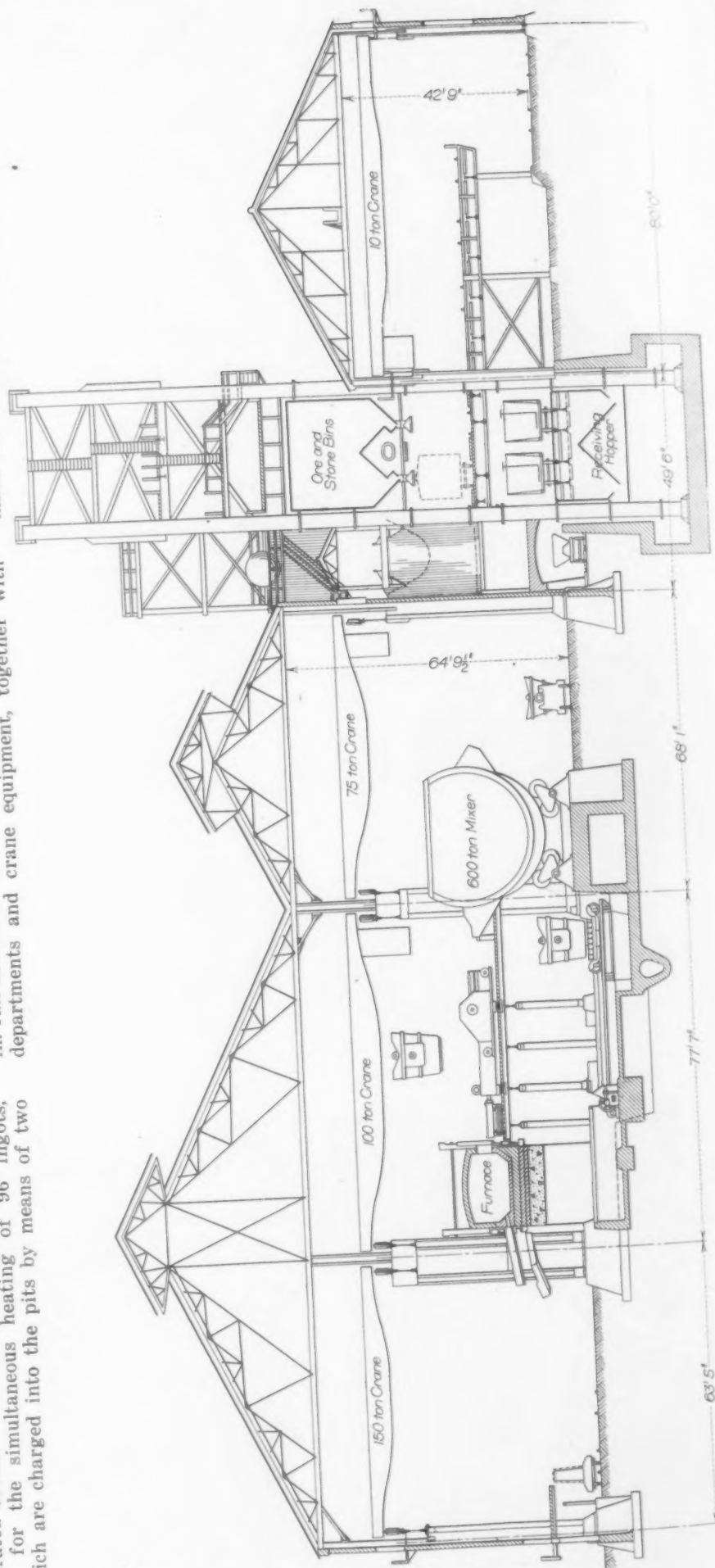
The soaking-pit building being an extension in a straight line of the blooming-mill building, the approach to the blooming mill parallels the furnaces.

The general layout of the blooming mill, 28-in. rail mill and 18-in. mill, with hot beds, finishing departments and crane equipment, together with

their relation to the merchant mill, is shown on the general plan in the supplemental plate. The accompanying table also indicates the plan of operating the mill with respect to the materials rolled. Throughout the mill is featured by the liberality with which massiveness has been incorporated into every detail. The mill pinions and principal roller table gears are machine cut and supplied with a positive force-feed system of oiling.

The mill presents its most conspicuous departure from the ordinary mill layout, where no attempt is made to roll such a variety of products, in the pro-

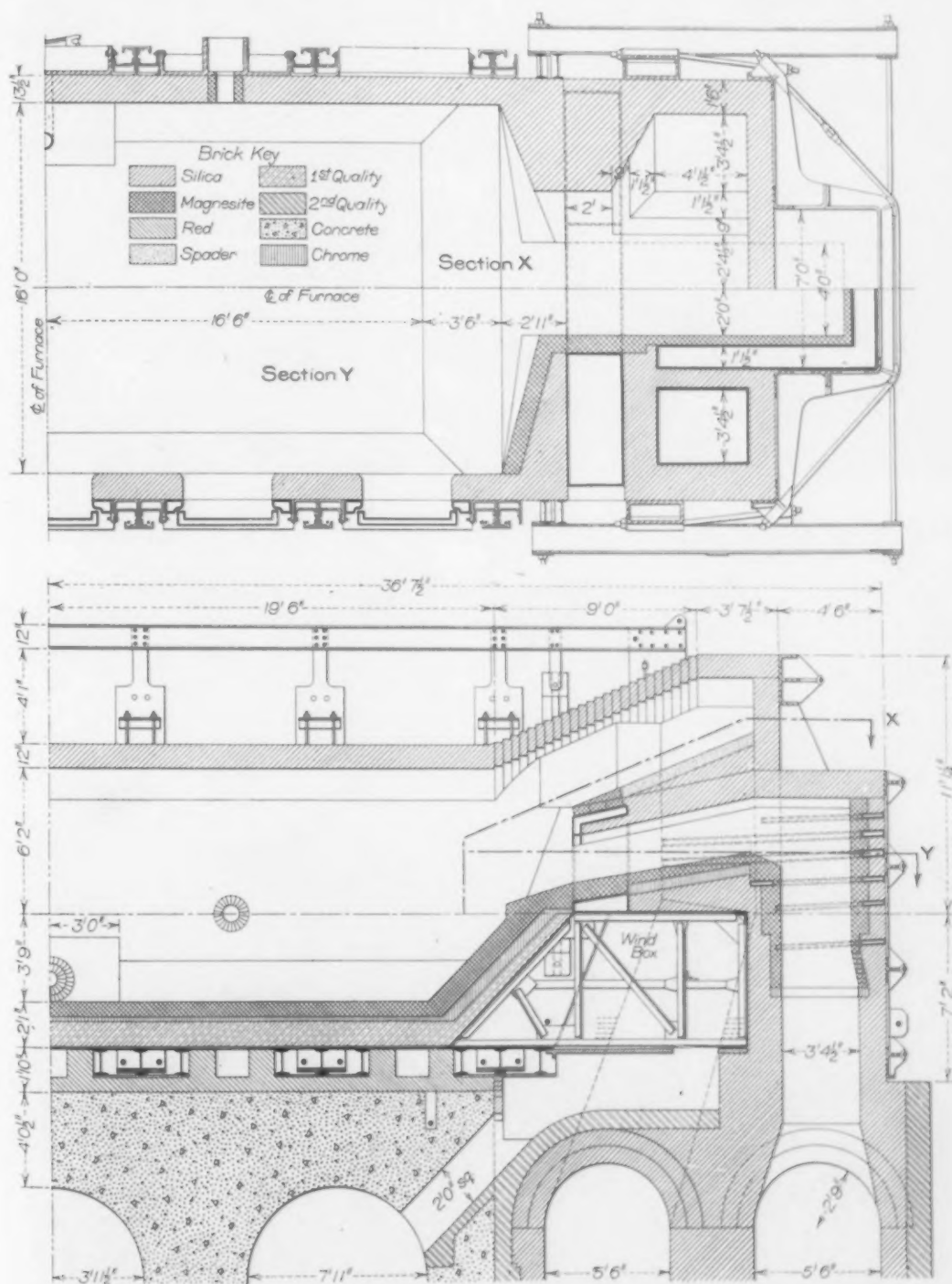
through the side of the building to the ingot yard, which parallels it. From this yard the approach is direct to the soaking-pit building, which is an extension of the blooming-mill structure. The soaking-pit building is 390 ft. 6 in. long and 95 ft. wide. The ingots are stripped immediately after entering the building at the northwest end by means of a 150-ton Morgan stripper crane. There are provided four 4-hole soaking-pit furnaces with electrically-operated covers. This affords an aggregate capacity for the simultaneous heating of 96 ingots, which are charged into the pits by means of two



Cross-Section Through the Open-hearth Department

vision for reheating the blooms and billets. The bloom or billet delivered from the blooming mill is sheared to 16-ft. lengths in a Morgan electrically-operated gap shear, from which it passes to a rotary transfer. This transfer is arranged to permit the continuous passage of the steel in a straight line from the blooming mill to the first stand of the rail mill, but its purpose is to transfer the 16-ft. length to the cross table at 90 deg., on which table it is

transfer table, elevates it to the height of the furnace charging opening and pushes it into the furnace. The movement of the steel in course of reheating through the furnace parallels the run of the mill. At the delivery end of the furnace the billet discharges on a second transfer roller table, upon which it may be either returned to the 28-in. rail mill or pass in the opposite direction for delivery to the continuous stands of the merchant



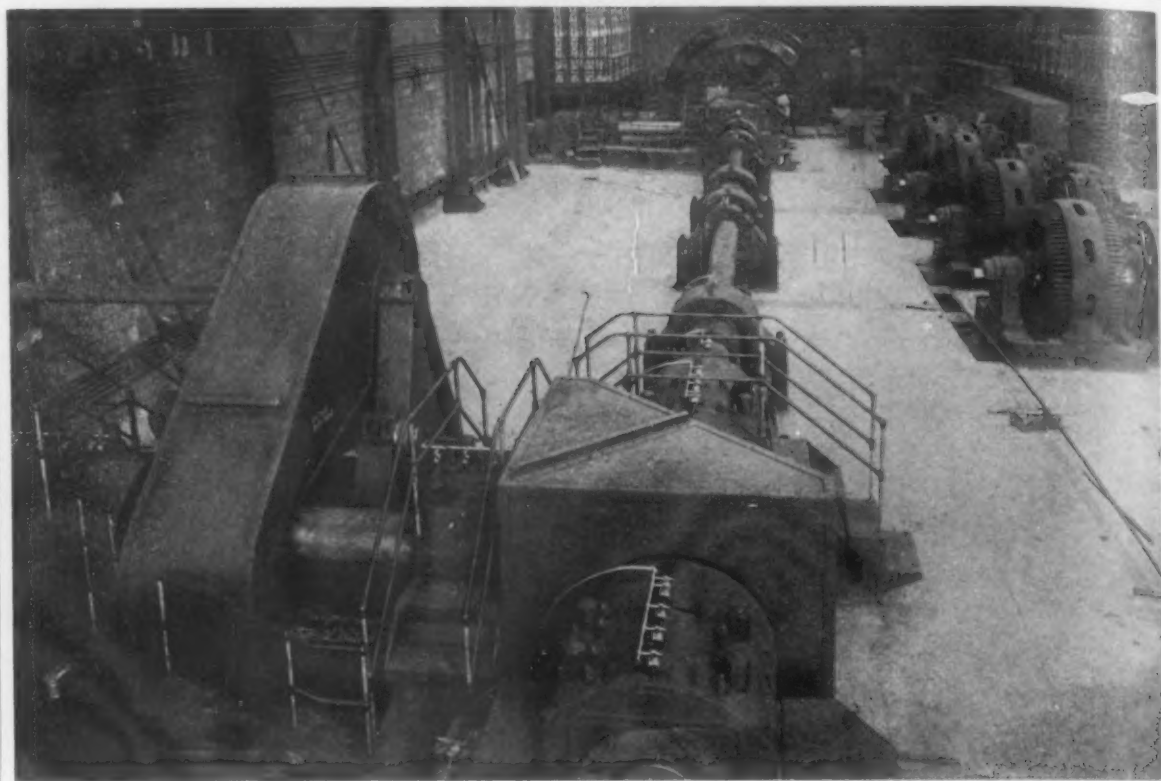
Sectional Elevation and Plan of Half of One of the Minnesota Open-Hearth Furnaces

delivered to the 16-ft. continuous reheating furnaces.

These furnaces are heated with producer gas and are operated on the regenerative principle. The general elevation of the furnaces, the location of the gas producer, with the gas connections between producers and furnaces, are shown in the drawings. Three reheating furnaces are installed. Each furnace is served by an hydraulically-operated charging ram, which receives the steel billet from the

mill, a rotary transfer at either end of the transfer table rotating the billet for its delivery to the mills. It is the expectation that practically all of the steel will be reheated.

The power units for driving the mills follow standard practice. The blooming mill is driven from a 40 x 66 x 60-in. Allis-Chalmers twin-tandem reversing steam engine developing 6000 hp. at 88 r.p.m. The manipulator for the blooming mill is hydraulically operated, and with the hydraulic



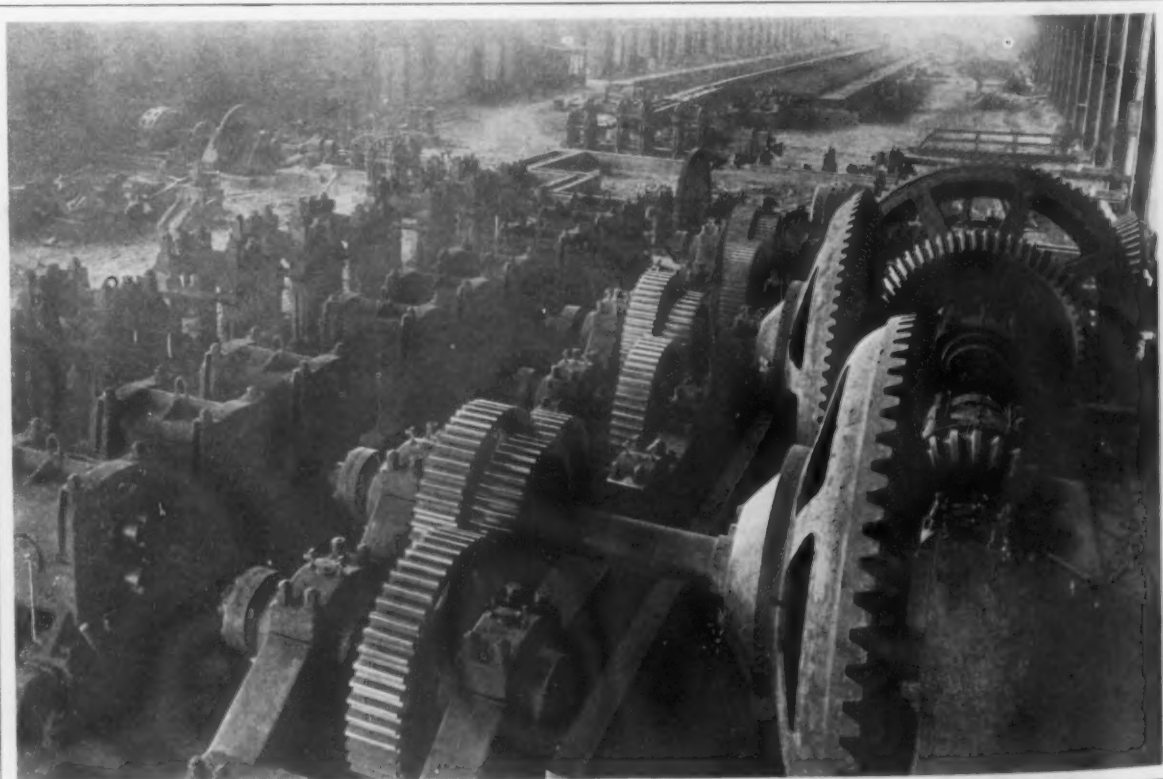
In the Background May Be Seen the 6000-Hp. Motor in Opposite Directions from Which Extends the Shaft Driving the Different Stands of the 28-In. Rail Mill Through Bevel Gears. At the Right in the Motor Room Are Motor-Generators

pusher installed for the charging of the reheating furnaces is the only hydraulic equipment installed at this mill.

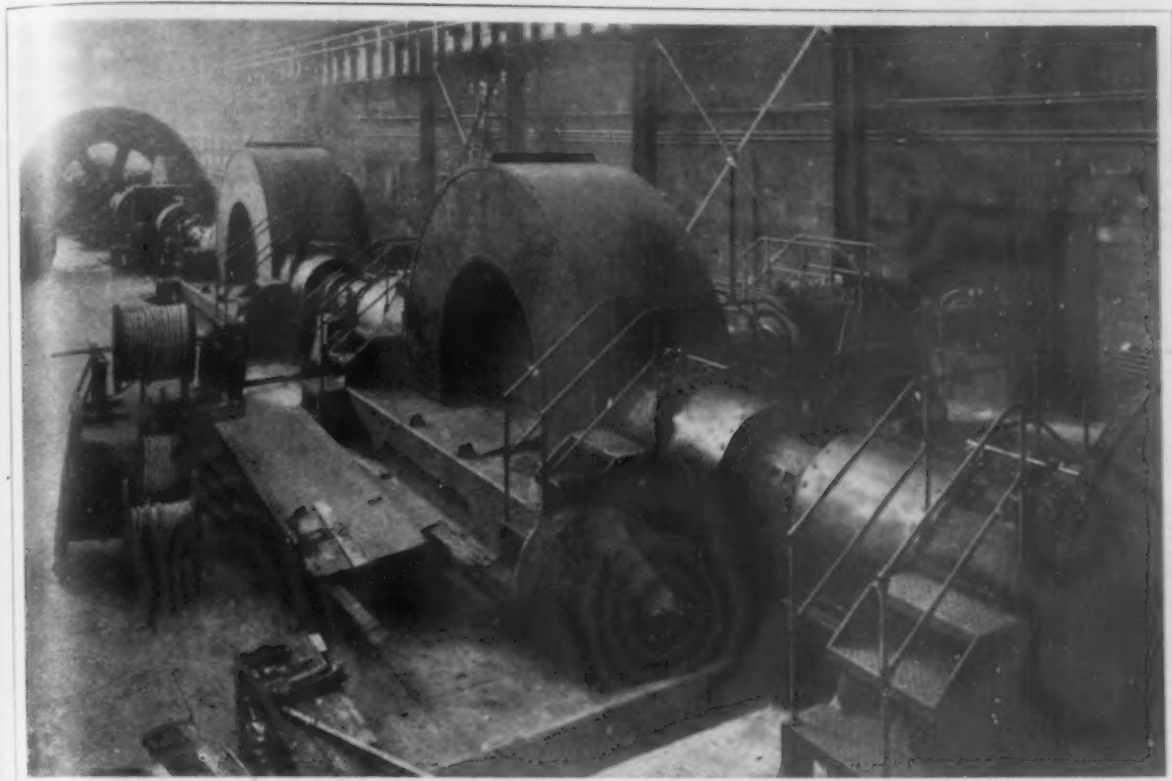
The main drive for the 28-in. mill is a 6000-hp. alternating-current Westinghouse motor. This motor is housed in the main motor room between the rail and merchant mills, which room also contains the 16-in. continuous-mill motor and rope drive.

The 28-in. mill motor is located to drive five stands of the mill on one side and three on the other, the power being distributed through the extended armature shaft with a bevel pinion and gear for each mill stand, all of which were furnished by the Allis-Chalmers Mfg. Company.

The mills and mill machinery were furnished by the Allis-Chalmers Mfg. Company and the Mor-



The Drive to the Continuous Mill, with the 10-In., 12-In. and 8-In. in the Background and the Hot Bed in the Distance



The Way the Gearing and Shafting for the Drive to the 28-In. Rail Mill Are Covered Is Here Shown, This View Giving an Idea of the Conditions on the Other Side of the 6000-Hp. Motor from that Shown in the Companion Illustration

gan Engineering Company and the motors by the Westinghouse Electric & Mfg. Company. The arrangement of the mill following the delivery of the finished pieces from the last stand to the row of five hot saws is indicated in the general drawing. After passing the marker and cambering machines, the rails or other sections are delivered to the hot-beds, which have a length of 175 ft. and a width of

113 ft. 4 in. At the delivery side of the hot-beds the roller table extends in either direction. Toward the right the rails are delivered to the rail-finishing department and toward the left the tables deliver to the structural and bar finishing departments. Directly opposite the hot-beds provision is made for the shearing and punching of tie plates and the finishing of splice bars, as well as the storage of



The Merchant Mill from the Finishing End, Showing Shears, Scales and Pilers, with the Double-Sloping Hot Bed in the Background

Sections Rolled at Duluth Mill

On the 28-in. rail mill

Rails	100-lb. to 60-lb.
Channels	9, 8, 7 and 6-in.
Beams	8, 7 and 6-in.
Angles	6x6, 6x4, 6x3½, 5x4 5x3½, 4x4, 4x3½, 4x3 in.
Flats	10 to 6-in. by 1½-in. thick to ½-in.
Rounds	5 to 3½-in.
Squares	4 to 2½-in.

On the 18-in. rail mill

Rails	45 to 20-lb.
Channels	5 and 4-in.
Beams	5, 4 and 3-in.
Angles	3½x3½, 3½x3 and 3x3-in.
Flats	6 to 4-in. by 1½-in. thick to ½-in.
Rounds	3½ to 2½-in.
Squares	2½ to 2-in.
Angle splice bars	100 to 60-lb.

On the Merchant Mill

Full range of bar sizes and sections.

Sequence of Roll Stands and Passes, Duluth Mill, Minnesota Steel Company

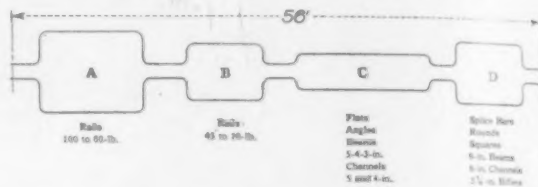
40-in. Blooming Mill.

Breaks down from 22x26x77-in. ingot to 8x8-in. billet.

28-in. Rail Mill,—rolls 56-in. long.

Stand 1-A... Pass No. 1.
 Stand 2-A... Pass No. 2.
 Stand 3-A... Pass No. 3.
 Stand 4-A... Pass No. 4.
 Stand 5-A... Pass No. 5.
 Stand No. 6... Passes Nos. 6 and 7. Finishes billets.

Typical Diagram of Roll Section—Stand 1-A



Stand No. 6 as part of 28-in. mill with 56-in. roll gives passes Nos. 6 and 7 on 100-lb. to 60-lb. rail section. Same stand as part of 18-in. mill, fitted with 38-in. rolls gives passes Nos. 6 and 7 on 45-lb. rail section.

Stand No. 7... Passes Nos. 8 and 9 on 100-lb. to 60-lb. rail.

Stand No. 8... Pass No. 10. Finishing 100-lb. to 60-lb. rail.

18-in. Rail Mill,—rolls 38-in. and 30-in. long.

Stand No. 6... Passes Nos. 6 and 7 on 45-lb. to 20-lb. rail.

Stand No. 7... Passes Nos. 8 and 9 on 45-lb. to 20-lb. rail.

Stand No. 8... Pass No. 10. Finishing light rails. Roll 30-in. long.

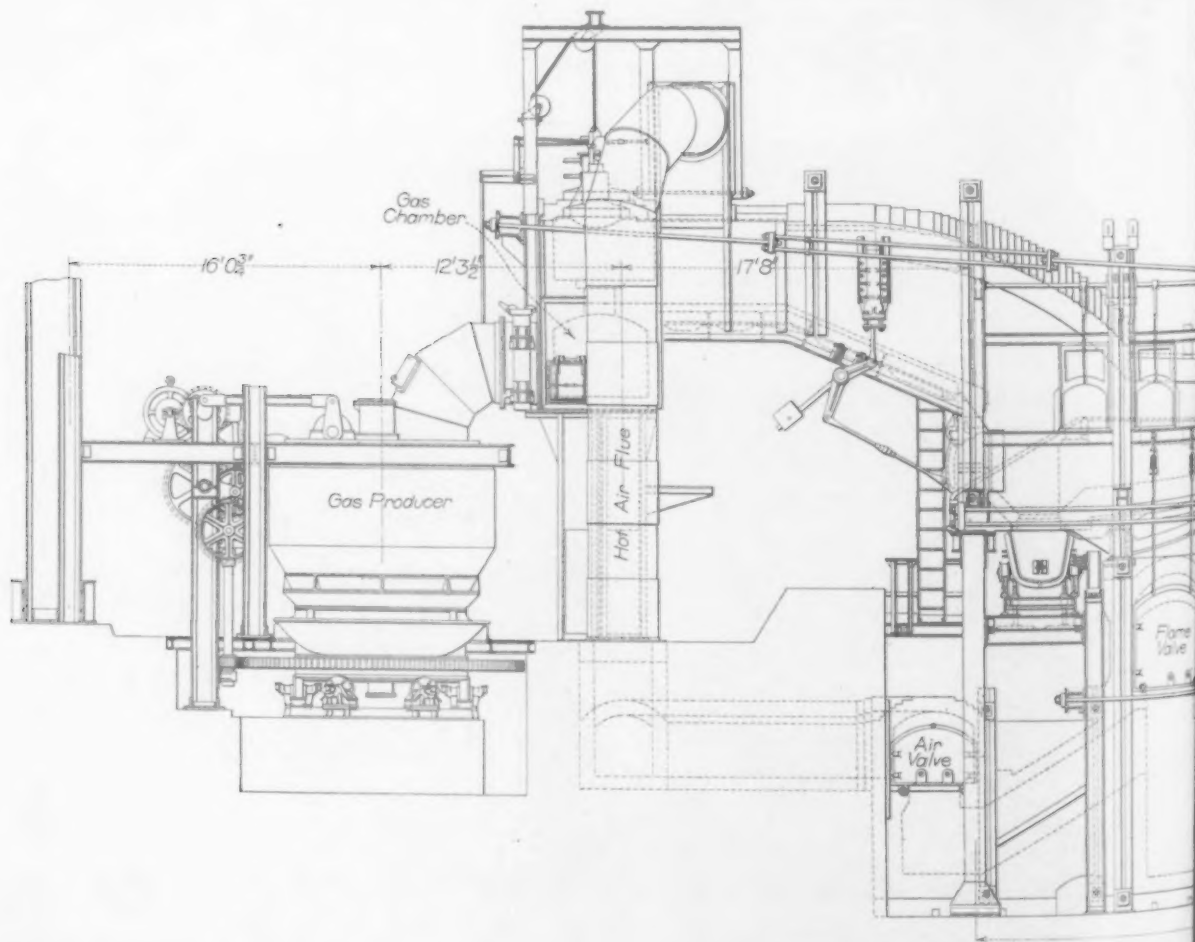
Merchant Mill.—See separate summary.

spikes and bolts. Into each of these finishing departments access can be readily had for shipping purposes by direct track from the yard.

The data covering the design and operation of the 16, 12, 10 and 8-in. mills will be found in the accompanying table. The cooling, shearing and straightening equipment of the merchant mill is of the standard type furnished by the Morgan Construction Company. The cooling bed is 300 ft. long and delivers material from either side, the bed sloping down from the hot run-out rolls in the middle to cold run-out tables at either side. These cold run-out tables deliver the bars to shears, and from the back shear tables the bars pass, on the one side, to a roller straightener, and on the other to an angle straightener. From the center line of these straighteners to the center line of the first pair of

shuffling bars the distance is 8 ft. 2 in., and from the first pair to the last pair of shuffling bars the distance is 60 ft. Then follow additional shears for cutting the bars to short lengths and, at the end of the mill, scales and bins from which to finally deliver the material for shipment.

Concerning the general feature of cement block construction for all of the mill buildings, comment



Elevation of Reheating Furnace for Merchant Mill of Minnesota Steel Company

Rail Mill Roller Tables

Lengths and Speeds

Table No. 2—Between passes 1 and 2,—rollers, 16 in. diameter, 4 ft. 6 in. long between guides; length (center line to center line) of passes 30 ft.; speed, 84.38 ft. per min.
Table No. 3—Length, 36 ft.; speed, 119.98 ft. per min.
Table No. 4—Length, 50 ft.; speed, 157.8 ft. per min.
Table No. 5—Length, 70 ft. 6¾ in.; speed, 270.6 ft. per min.
Table No. 6—Length, 90 ft. 2½ in.; speed, 405.8 ft. per min.
Table No. 7—Length, 109 ft. 4½ in.; speed, 377.8 ft. per min.
Table No. 8—Length, 181 ft. 0½ in.; speed, 405.8 ft. per min.
Table No. 9—Length, 157 ft. 4½ in.; speed, 403.9 ft. per min.
Table No. 10—Length, 180 ft. 0½ in.; speed, 403.9 ft. per min.

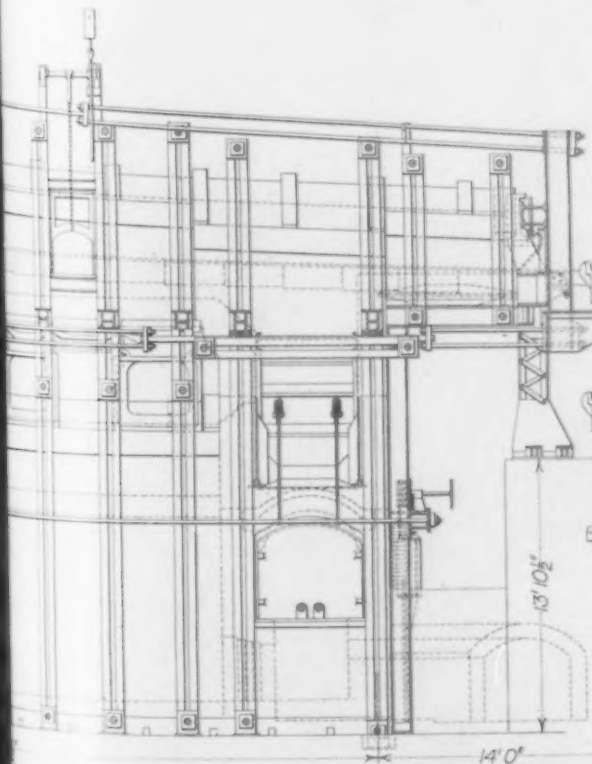
has been previously made. The accompanying sketch shows the shape of the blocks and the manner in which they are laid. The result is an ex-



Typical Cement Block Wall Section for Mill Buildings, Minnesota Steel Company

ceedingly substantial and very warm building. The construction is also relatively cheap, largely because of the manufacture of the blocks at the works from material excavated in the construction of the mill. The use of rough finished cement for walks in most of the buildings, and also the use of channel sections laid with flanges projecting upward and filled level with cement for steps in all of the stairways is also a feature.

The organization which will conduct the operation of the Duluth mill includes George L. Reis, vice-president; S. B. Sheldon, general superintendent; K. C. Hoxie, chief engineer; W. R. Pendry, superintendent of coke ovens; A. O. Baer, superintendent of blast furnaces; P. B. Wheeler, superintendent of the open-hearth department, C. A. Thayer, superintendent of the rail mill; C. C. Sampson, superintendent of the power station, and J. H. Smith, master mechanic.



Gas Producer at One End and Charging Pusher at the Other

Merchant Mill—Condensed Summary

Includes 16-in. continuous mill, 12-in., 10-in. and 8-in. mills

16-in. Continuous Mill.

Driven by rope drive from 3000-hp. motor.
Motor speed, 214 r.p.m.
Diameter of driving wheel, 16 ft. 6 in.
Diameter of driven wheel, 7 ft. 6 in.
No. of ropes, 56 strands 1¼ in. in diameter.
Mill takes 4x4 in. billet.
Delivers bar 1.157 sq. in. area.
No. of passes, 9.

12-in. Mill.

Driven direct from 3000-hp. motor at 214 r.p.m.
Delivery speed of rolls, 671.96 ft. per min.
Length of rolls, 24 in. for 3-high stands, 16 in. for the 2-high.
Two 3-high stands and one 2-high.

10-in. Mill.

Driven direct from 600-hp. motor at 365 r.p.m.
Delivery speed of rolls, 956.3 ft. per min.
Length of rolls, 18 in.
Two 2-high stands.

8-in. Mill.

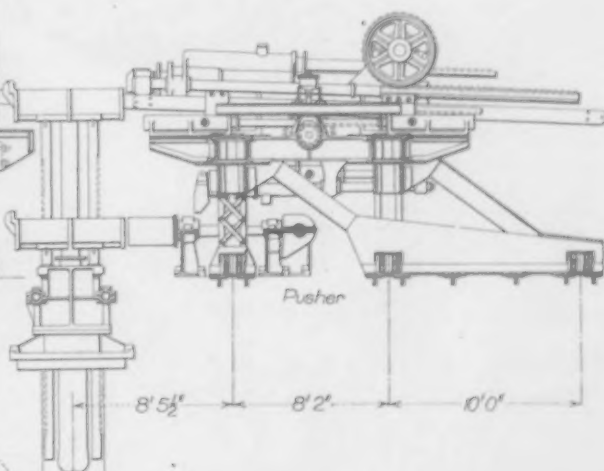
Driven direct from 500-hp. motor at 487 r.p.m.
Delivery speed of rolls, 1016.178 ft. per min.
Length of rolls, 12 in.
Two 2-high stands.

Substitute for Sulphuric Acid in Pickling

A circular issued by the Research Mfg. Company, Oak Lane Station, Philadelphia, points out that the elimination of sulphuric acid fumes is accomplished and many other advantages are attained in the pickling of metals for the removal of scale or oxide by the use of a compound which was perfected in the mills of the Ellwood Ivins' Tube Works, Philadelphia. It has been in use in the tube works for some time, but until recently was held as a shop secret. It has been named Edis Compound.

The compound is shipped in the form of dry cakes or lumps which are dissolved in water almost up to the boiling point. It is essential that the solution be very hot, and when being worked about 200 deg. should be maintained. To accomplish this end, the Research Mfg. Company suggests that the free end of a live steam pipe be inserted into the pickling tub, letting the steam condense in the solution. Where the tubs are very long the pipe may be tapped in several places. A piece of copper pipe should carry the steam into the solution.

It is also recommended that the tubs be covered, as this serves to keep the solution hotter, though this is entirely a measure for economy. It is pointed out that it is desirable to make the covers in sections to permit of easier handling. The solution is applicable to iron, steel, brass, copper, etc.



NEW OXYGEN GENERATOR

Filter Press Type with Special Cell Arrangement and Insulating Diaphragms

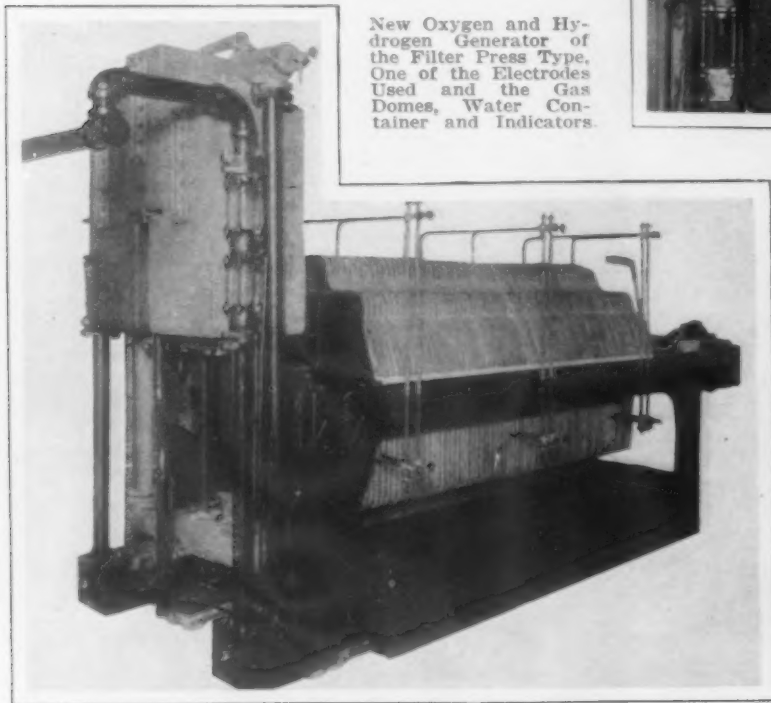
A new machine for the electrolytic production of oxygen and hydrogen has been placed on the market by the International Oxygen Company, 115 Broadway, New York City. This machine differs in appearance very materially from the one illustrated in THE IRON AGE, Aug. 17, 1911. That type roughly resembles a large iron pot, while the new type of generator in its outward appearance looks very much like a filter press, such as is used in many chemical industries. The new generator is known as the bipolar type and among the features upon which special emphasis is laid are an automatic water feed, the prevention of mechanical mixing of the gases, the use of a special type of electrode to decompose the water with a nickel anode and an iron cathode and a diaphragm of asbestos fabric to insulate the cells.

The new generator consists of a series of metallic plates, clamped together in a heavy frame, each plate being insulated from the other electrically and also separated by the diaphragm of porous fabric. Each pair of electrodes forms a closed cell which is filled with a solution of caustic potash or soda. The electrodes are carried on two steel rods and are clamped together by a heavy screw

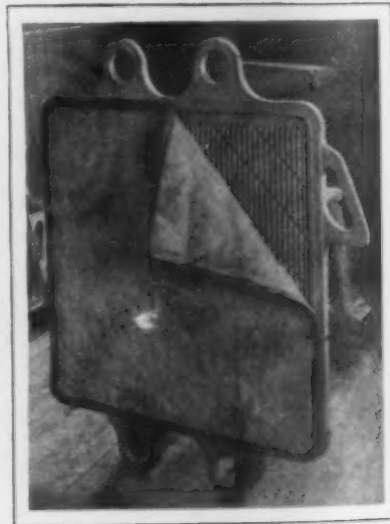
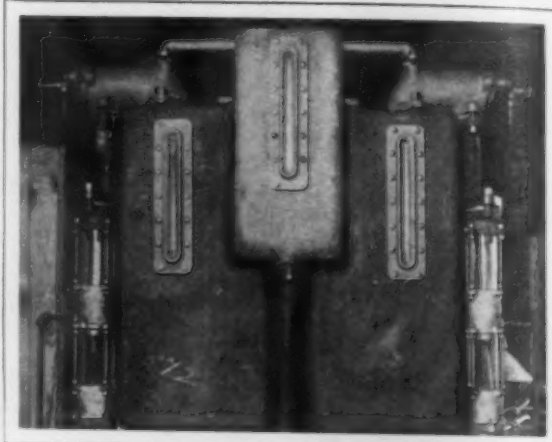
take. In this way each half of the cell has its own independent water intake and gas outlet, which it is emphasized eliminates the possibility of the two gases mingling in the cell. The diaphragms used are of especially prepared asbestos fabric, having a packing rim of rubber all around the edge which rests in a recessed groove on the face of the electrode.

Special insulators are used to insulate the electrodes from the side bars and nipples of pure rubber inserted in the water intake and gas off-take shoulders of the electrodes serve to supplement the rubber packing rims surrounding the diaphragm. When the electrodes are clamped in position these nipples meet one another, thus forming an insulating tube in the interior of the water intake and the gas off-take.

The gases rising from the electrodes and entering the gas off-takes contain a small percentage of



New Oxygen and Hydrogen Generator of the Filter Press Type. One of the Electrodes Used and the Gas Domes, Water Container and Indicators.



working in the rear support. A ball thrust bearing is interposed between the end of the clamping screw and the rear end plate and is relied upon to do away with the tendency of electrodes to ride up from the side bars under the pressure of the clamping screw.

The electrodes are of special design, the anode side being covered with nickel, while the cathode is of commercially pure iron. Vertical corrugations on the surfaces of the electrodes are relied upon to facilitate the flow of the electrolyte into the cell and the release of the gases. There are two openings at the top and bottom of each electrode communicating by a cored channel with opposite sides of the plate, those at the bottom being for the water intake and those at the top for the gas off-

take. In this way each half of the cell has its own independent water intake and gas outlet, which it is emphasized eliminates the possibility of the two gases mingling in the cell. The diaphragms used are of especially prepared asbestos fabric, having a packing rim of rubber all around the edge which rests in a recessed groove on the face of the electrode.

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The gases rising from the electrodes and entering the gas off-takes contain a small percentage of

the electrolyte and to eliminate this an insulating section consisting of two pieces of heavy glass tubing clamped between iron flanges is placed in the gas off-take to intercept and drain off the entrained moisture. From the gas off-takes the gases pass through the gas domes into the purgers. These are closed cast-iron boxes partially filled with water and the gases escape from below the surface of the water, pass upward and emerge through the supply lines to the gas holders. The purgers are relied upon to remove any entrained fluid from the gas and cool it and also act as a water check valve preventing any excessive pressure of the gas holders from being transmitted to the pressure system of the generator.

In operation the generator is filled with a solu-

tion of caustic potash or soda and an electric current is admitted at one end plate which passes on through the plates and the solution to the other end of the generator. In its passage it decomposes the water in the solution into oxygen and hydrogen, which are released from opposite sides of each plate and pass into the gas off-takes. As the gases are released, the solution is replenished from the two supply tanks or domes on the front of the generator. These have glass water level indicators and pipes descend from the tanks to the water feed manifold, which branches into two pipes connecting independently with the two water intakes and also into two risers leading to the independent gas domes. As the oxygen and hydrogen are carried into these domes as generated, the feed water tank discharges distilled water through a float-controlled valve to the solution tank on the front of the generator. The apparatus is arranged so that the fluid level is maintained automatically throughout the system, the two independent water intakes to either side of each electrode being relied upon to prevent mingling of the oxygen and hydrogen through the water supply. This arrangement for feeding the water, it is pointed out, causes the pressure throughout the generator to be balanced and makes the water feed proportioned to and under the control of the rate of gas generation.

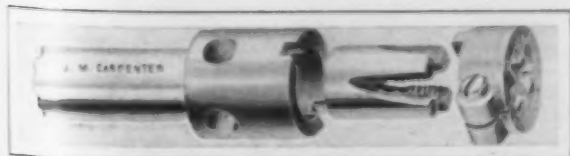
The two independent water supplies, one to either side of each diaphragm are subjected to the same pressure due to the hydrostatic head in the solution tank which is relied upon to eliminate circulation through the diaphragms due to unequal pressures on their two sides. The gas pressure is controlled by the hydrostatic head in the dome through the two independent risers from the water-feed manifold and as the pressure is the same in the case of both gases in the individual cells it is pointed out that there is no mixture of the gases and the balancing of the pressures on the diaphragms is assisted. Gas and water pressures are predetermined and constant in all cases.

A signal whistle is provided to give notice when the solution falls below the prescribed level. Glass sight-feed indicators on the solution tank and the gas domes show the fluid levels and the rate at which the gases are being generated. The fluid level in the body of the apparatus is shown by gage glasses connecting with the electrodes at intervals along the generator.

Several different sizes of generator are built, the one illustrated having a daily capacity of 3600 cu. ft. of oxygen and 7200 cu. ft. of hydrogen. This capacity is equal to fifty of the old unit type cells, and the floor space required, 75 sq. ft., is only one-sixth of that required by this number of unit cells. The current required is 320 amp. at 120 volts.

New Holder for Spring or Prong Dies

Patents have been recently granted to the J. M. Carpenter Tap & Die Company, Pawtucket, R. I., covering a new holder for spring or prong dies. The special feature claimed for the use of these holders is



Holder for Spring Dies Designed to Support the Tool by Locking Dogs on an Adjustable Ring That Is Firmly Locked to the Holder

that they provide a support near the outer ends of threading dies and mills or other tools made in the form of what is commonly known as prong, spring or acorn dies. In this way, it is emphasized, the twisting of the lands or prongs which occur by reason of lack of support is eliminated.

The holder consists of an adjustable ring with a set of lugs which fit in stops in the body of the holder and are firmly locked in place. In addition these lugs or stops engage the back of the prongs near the outer end and are relied upon to keep the prongs firmly in place while they are being subjected to the strain of cutting material.

Truck with Special Lowering Device

The Steubing Truck Company, Cincinnati, Ohio, is now manufacturing a lifting truck with many features claimed to be new. It is of the four-wheel type of all-steel construction. A very interesting feature of the



A Lift Truck Equipped with a Special Device for Lowering the Platform Without Placing a Load Upon It

truck is its bar-steel construction, which not only adds to its strength, but enables the manufacturer to build it in any length or width required. Another point upon which emphasis is laid is a special device for lowering the lifting platform quickly without placing a load on it.

The lever lifts the platform and load by a hook, as was the case with the three-wheel truck illustrated in THE IRON AGE Sept. 23, 1915. The hook automatically disconnects to permit free use of the lever and steering mechanism. The front wheels can be turned completely around with the platform in either the raised or the lowered position, permitting easy handling of the truck in cramped quarters or making sharp turns. On account of the lever being free, the truck can be guided under the platform at will.

The truck is equipped with a hydraulic check for lowering the loads. By pressing a foot lever the load is released, allowing it to be lowered automatically under control by the hydraulic check. The different sized trucks have wheels of 6, 7, and 9 in. in diameter, and any size wanted can be furnished with different models. Hyatt roller bearings are used throughout.

Lifting Magnets with Increased Capacity

The Cutler-Hammer Clutch Company, Milwaukee, Wis., has brought out a new series of lifting magnets of the same general type as the one illustrated in THE IRON AGE April 7, 1910, salvaging a boatload of barb wire and nails from the muddy bottom of the Mississippi River. This new line of magnets is characterized by increased lifting capacity ranging from 20 to 60 per cent, a 62-in. magnet, for example, having had its lifting power increased from approximately 2600 lb. to a minimum of 4000 lb. This increase, it is pointed out, reduces the number of magnets, cranes and crane operators required, and in many cases it is possible for two of the new magnets to do what formerly required three.

The Maryland State Industrial Accident Commission has decided that a chronic ailment is no bar to the award of compensation even though the ailment contributed to the accident.

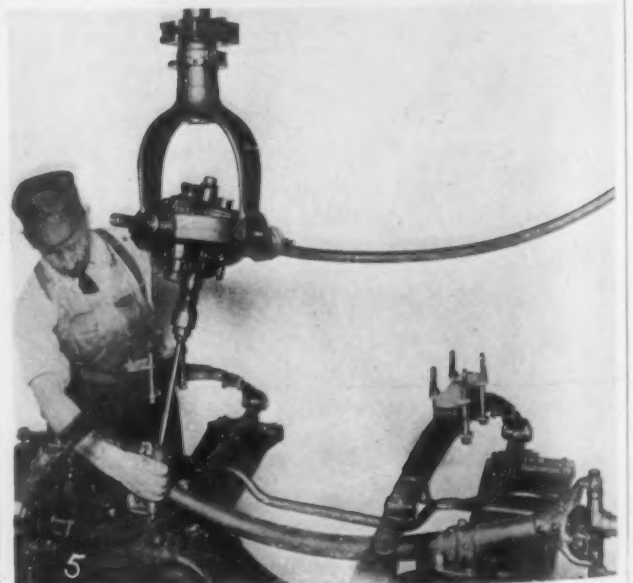
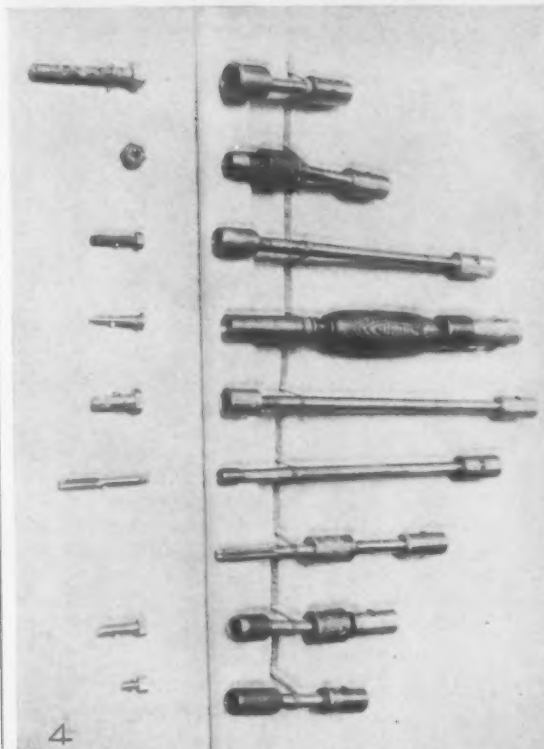
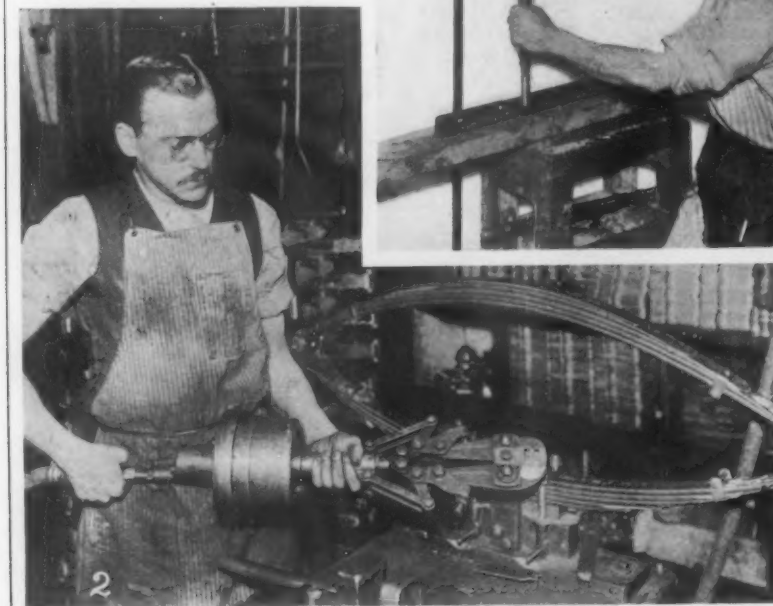
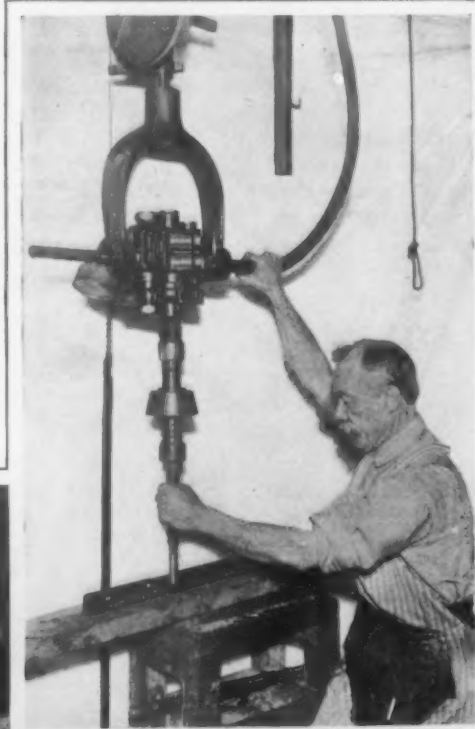
Shop Pneumatic Devices Which Effect Great Savings

A Recent Development in the Franklin Automobile Works

A NUMBER of compressed air devices are now in use in the works of the H. H. Franklin Mfg. Company, Syracuse, N. Y., maker of the Franklin automobile, for facilitating production and thus decreasing the cost of the motor cars, not to mention the lightening of the physical labor of the workmen. Some of them and the operations are here illustrated. The startling facts lie in the time saving as against hand operation, and the figures given below, obtained from George D. Babcock, production manager of

the company, are based upon "exact fundamental time study, both of the old hand methods and of the new machine methods, and are being attained regularly."

In driving transmission studs and screws and other wood screwing on the sill, as in No. 1, the time saving is 75 per cent. In bolt clipping, as in No. 2, the saving is 56 per cent., and the special jaws last twice as long as formerly. The saving in handling all engine studs, screws and nuts, No. 3, is 71 per cent. The saving with the fixture and pneumatic

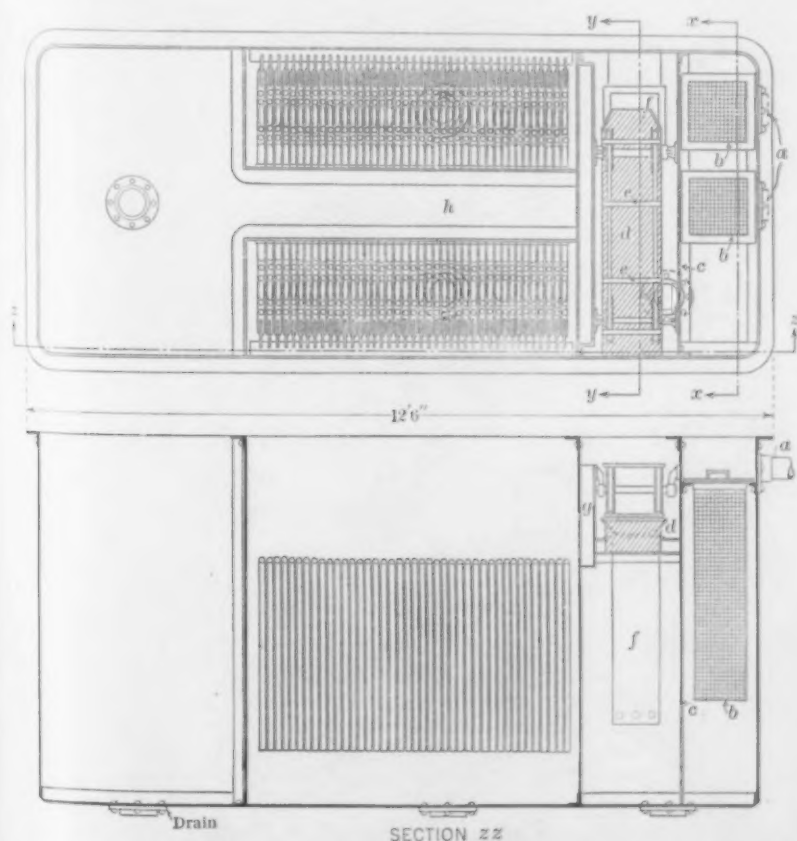


wrench, shown in No. 5, in driving the front axle spring clip nuts, as against the hand wrench is 56 per cent. The various sockets and the parts driven by the sockets are shown in No. 4.

New Cutting Oil and Compound Filter

The line of oil filters manufactured by the Richardson-Phenix Company, Milwaukee, Wis., has been recently increased by a line designed especially for purifying cutting oils and compounds. Where the filters are to be used in plants working on ferrous metals a magnetic separator is provided. Means can also be provided if desired for sterilizing the oil, thus removing the danger of scratches becoming infected through contact with bacteria-laden oil. A number of different sizes of filter are built, the one illustrated having an hourly capacity of 10,000 gal.

In operation the used oil enters the inlet *a*, passes down through the strainer baskets *b*, where the large cuttings are removed and flows under the baffle *c*. It passes up on the opposite side of this plate and across the top of the magnetic separator *d*, where the iron and steel chips are removed. An endless chain belt causes scrapers *e* to travel across the face of magnets and remove the accumulated chips. These are carried into the chip retainer *f*, having holes covered by screens to enable the oil to drain out. When the retainer becomes filled with chips, it can be slipped to one side and removed so that the contents may be emptied. After the oil passes over the magnet it flows over the dam *g* and into the filtering compartment in which the individual filtering units are located. The lubricant entirely surrounds and flows through these units, which are relied upon to remove even the most minute particles of foreign matter. The clean oil passes into the compartment *h*, provided for that purpose, and from there a pump forces it to the overhead reservoir or directly into the oil distributing piping which is equipped with a relief valve to maintain the requisite pressure.



A Collet Holder for Spring Dies with a Spring Adjusting Chuck Designed as a Substitute for the Ordinary Split Collar

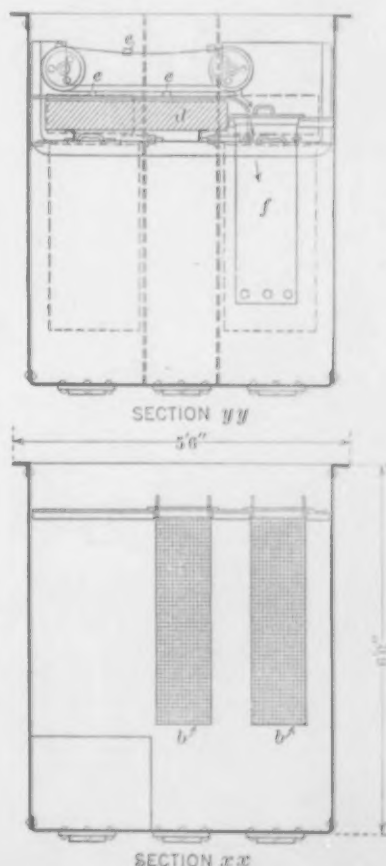
Collet Holder for Spring Dies

A collet holder for spring dies, designed to take the place of the ordinary split collar, has recently been brought out by the National-Acme Mfg. Company, Cleveland, Ohio.

Several advantages are claimed for the collet holder. One is that all the lands of the die are adjusted evenly. Another is that the collar is provided with a float similar to that used on the company's opening dies, which allows the die to center itself on the work.

This holder consists of a spring adjusting chuck which has a bearing on die lands and over which a master holder is adjusted for the cutting size with a spanner wrench. Then with the wrench a ring is drawn against the bottom of the master chuck to hold the latter in place and lock the adjustment. The backs of spring dies used for the holder are slotted to receive two pins which are relied upon to hold the die from turning in the holder under the cutting strain and further assure the permanency of the adjustment. This does away with spotting spring dies, which is necessary when a collar is used.

The collar is built in five sizes, to accommodate spring dies of cutting capacity from $\frac{1}{8}$ to 1 in. One holder will accommodate spring dies of several different cutting sizes.



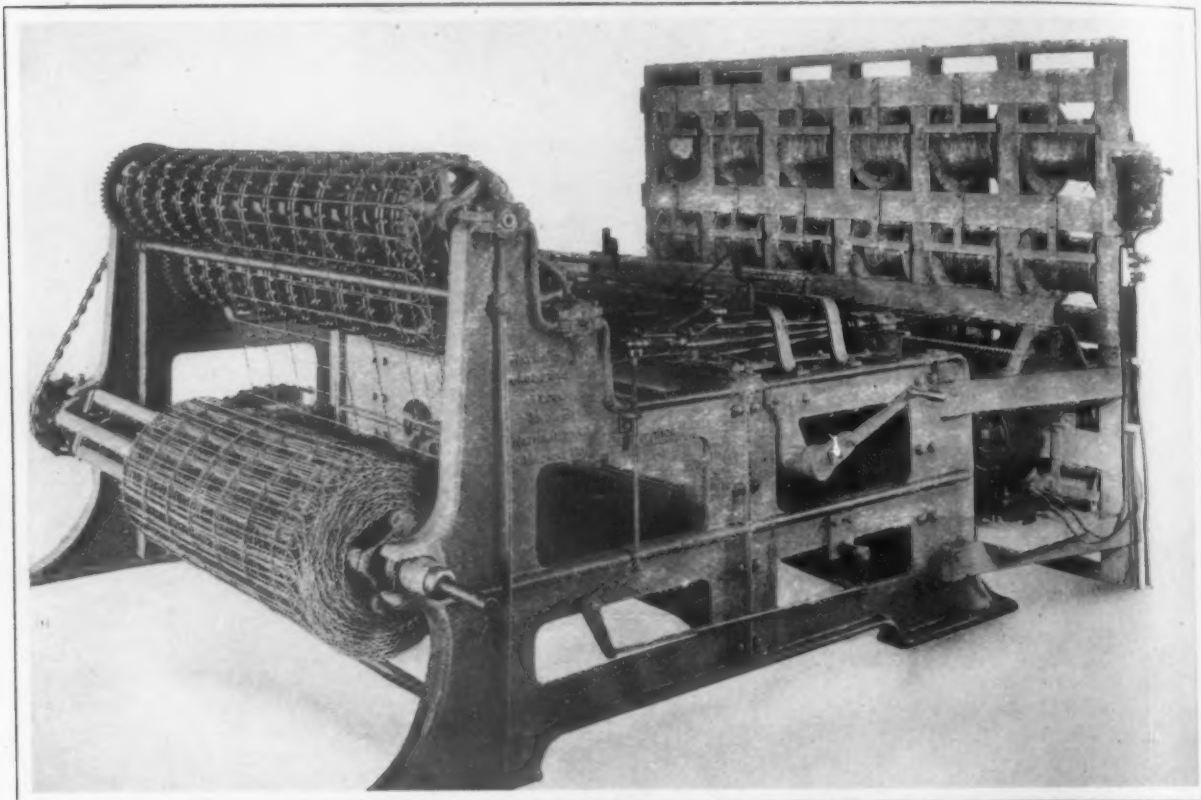
A New Filter for Purifying 10,000 Gal. of Cutting Oil and Compound Hourly, Equipped with a Magnetic Separator

Ornamental Wire Fence Machine

A machine for weaving ornamental fencing for door yards, parks and boulevards and industrial establishments where something a little more beautiful than the standard type of wire fence is required, has been developed by the National Fence

principle of a micrometer is set on the adjusting ring. The chasers are held from side play by eccentric binding screws, which are tightened against the sides of the chasers after an adjustment to cutting size has been made.

Two important advantages are claimed for this die. One is that it can be used for short-cut threads where



A Loom for Ornamental Wire Fencing Consisting of Twisted Horizontal Wires and Inserted Arched Pickets

Machine Company, 827 Grand River Avenue, Detroit, Mich. The output of the machine consists of horizontal line wires or cables made of two strands of wire twisted around each other and holding transverse strands spaced at intervals throughout the fence. The machine takes the wire from a series of reels, as shown at the right of the accompanying illustration, and delivers the completed fence rolled as shown at the left.

The machine is automatic in operation, the wire being fed through the machine, the spacing of the pickets gaged and means provided for varying the spacing of the pickets to change the mesh of the fence. The machine also has a twisting head and forming device to enable an arched intermediate picket to be formed and introduced in a portion of the fence fabric. The arch of this picket is divided by alternate pickets.

The machine is operated entirely by power, the consumption, it is stated, being not more than 2 hp. The capacity of the machine is 1500 ft. of different heights of ornamental fence per day.

Threading Die with Adjustable Chasers

A new adjustable chaser die has been brought out by the National-Acme Mfg. Company, Cleveland, Ohio. This die has few parts and is made strong for heavy-duty work. The chasers are set in a one-piece body. They are adjustable for tight or loose fitting threads by a ring which carries a hardened dowel pin against the backs of the chasers. A gage that operates on the

time which might be saved by an opening die is too small to be of advantage. The other advantage is that it involves a smaller investment than is required for an opening die and answers the same purpose, it being claimed that with its use the same results in accuracy and approximately the same results in production can be attained as with an opening die. It is pointed out that this die has an advantage over button



New Die of Simple Construction Having a Micrometer Adjusting Ring for the Chasers

dies in that it is sharpened much easier because the chasers are separate pieces that can be taken out and ground and the substitution of a new set of chasers makes a new die. It is made in eight sizes, with a capacity from $5/32$ to $5\frac{1}{2}$ in.

THE PRICE OF CASTINGS

Why Maker and Taker Should Discard Buying by the Pound Only

BY H. M. RAMP*

Two great questions in the foundry business are: the cost of castings and the price of castings. These represent two vital phases of the industry, the manufacturing end and the selling end.

Volumes have been written about cost reports and cost keeping, about organization and equipment. Fortunes have been made and lost in labor-saving devices for this industry. Concerns have been wrecked and reputations blasted by holding the cost sheet of castings so close to the eyes that it obscured from the horizon of vision the fact that the price of the casting also rests partly with the producer. It is not that too much attention has been paid to cost or progress or development of the industry, but rather that too little effort has been expended in marketing the product.

FOUNDRYMAN STRIVES TO SAVE BUT NOT TO SELL

The foundryman is proverbially a poor salesman. He is no match for the scientific policies of the purchasing agents of to-day. And if he cannot procure a profitable price, he accepts a lower one and says, "If so and so can make a casting for that price, so will I," and puts forth twice the effort and brains into trying to reduce his cost in the shop that it would have taken to procure a favorable price if his efforts had been properly directed.

And the foundryman says there is little to do in price setting from his end; he must submit his price and the lowest bidder gets the contract. This is not true, or where it is true, the foundryman has not thoroughly explored his market and its possibilities. It is just as reasonable that one foundry should get a better price for castings than another, as it is for one mill to get a better price for its cloth than another because of its reputation and stability. We all remember how many years Rogers Brothers held the market on silverware because of the quality of their product, and so it is in almost every line.

If the foundryman permits the purchaser to hold him to the shoddy level of price, and asks for the broadcloth quality of product, it is his own fault.

There is more in the business than furnishing an article that will pass inspection and just do. There is the question of service; of finding out what the customer wants; of going into his shop and studying what he needs; of finding out what are his delays and expenses in handling his castings; of working with him to eliminate these troubles and expenses; of making and furnishing a product to conform to his peculiar needs.

CUSTOMER'S NEEDS RARELY STUDIED

Or it may be the question of deliveries, or pattern equipment or something else. But whatever it is, there is always some way or some place that the foundryman can make his product or his service superior to his competitor's, if he studies the requirements of his customers as carefully as he does his own shop cost. Then his request for a price commensurate with the service rendered will be met in an entirely different spirit than if it were a competitive bid.

A contract may have to be taken the first time on the competitive basis, but the foundryman who permits it to stay there never gets any closer to his customer than the office railing.

*President Elmwood Castings Company, Cincinnati.

The selling end of the foundry has very seldom been developed in comparison with the other industries of our nation. It savors strongly of the traditional methods. To-day we sell castings by the pound or the job or yearly contract. We take a contract at $2\frac{1}{2}$ c. per lb. where the product will cost from $1\frac{3}{4}$ to 10c. per lb. from the different patterns. And one month the foundry will have a preponderance of the cheaply made work, and the next month of the expensive.

Furniture or locomotives or carpets or machine tools are not sold by the pound. The individual cost of each article is computed and its selling price set accordingly. The man who sells the street car or a door lock buys his raw material by the pound, as does the foundry, but he sells his product according to a fixed and definite knowledge that he is making money on all his output, or knows why not.

But the foundryman's grandfather sold his castings by the pound, and the purchaser realizes that under the pound system he can change his design or lighten his patterns, or do a number of other things that will react to his favor, and he naturally favors the pound price.

The correct method of charging for castings would be to sell them by the piece. It would be just to the producer and would have its advantages for the consumer. It would mean that the foundry business would be placed upon a more stable and definite basis and that the foundryman would not be conducting his industry at a loss one month and an abnormal profit the next.

In some instances this system has been introduced. But some foundrymen will say, "It would involve too much work to make a price on every pattern." This is one of the answers that shows the indifference of the foundryman to the selling end of the game. He hesitates to go to the trouble to find out what it costs to produce. The hardware merchant does not hesitate to make a different price on his every article. Even nails command a different pound price for different sizes.

WHEREIN THE BUYER GAINS ADVANTAGES

The actual cost of each casting would enable the customer to realize what he is paying actually for different parts. It might explain to him why the cost of his castings on some of his output made it difficult for him to meet his competitor's price. It might also point the reason why he could produce an article at a cost apparently less than his market competition. It would show him also what are his expensive castings and give him the opportunity through co-operation with the foundry to change his design, so that the price might be materially reduced.

Bulb Angles and Beams for Shipbuilding

The Carnegie Steel Company, Pittsburgh, Pa., has issued a pamphlet containing tables and data on all the bulb angles and bulb beams rolled by it. These sections were formerly used to some extent in shipbuilding, but later on were supplanted by steel channels. Recently, however, the tide has turned again in favor of the bulb angle and beam type of construction, and in addition the former are employed for strengthening the top of steel gondola cars. Profiles of the various sections rolled which conform to the standards adopted by the British Standards Committee are shown with tables of dimensions and weights. Tables of the elements of the different sizes of the various sections are included.

The entire plant of the Slatington Rolling Mills, Slatington, Pa., has been sold to Edwin German at a price of \$31,500. Mr. German has not fully decided what he will do with it.

ESTABLISHED 1855

THE IRON AGE

EDITORS:

GEO. W. COPE

A. I. FINDLEY

W. W. MACON

CHARLES S. BAUR, *Advertising Manager*

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Business and the Trade Commission

Those who discuss publicly the commercial and economic problems created by the war agree that no man can forecast with any certainty the conditions that must be dealt with when it ends. Yet the very diversity of views expressed will stimulate deeper probing and thus help to determine the lines of future trade development. It is not surprising that the effort to shape the policy of the Government at Washington and of large manufacturing and financial interests, with a view to the largest benefit to this country in the new alignment of international trade, should bring out more or less partisan bias. Tariff, shipping, trust and to an extent currency legislation has all developed party differences. And there are plenty of indications that the debates on national defense that will be in full swing early in the new year will be marked by political maneuvering against the needs of the national election. That is an unfortunate but an inevitable feature of the decision of important questions in a democracy.

There has been no concealment of the feeling of many business men against some of the policies and proposals of the present administration and the two that preceded it. But that has not prevented a recognition by manufacturers of the evident attempts made more recently to promote better relations between those in charge of the Government and those in charge of commercial and manufacturing interests. Particularly have the utterances of members of the Federal Trade Commission tended to promote a better feeling, even though there have been less reassuring developments in other Administration circles. Chairman Davies, in addressing the American Manufacturers' Export Association in New York last week on "The European War and Industrial Democracy," added to the impression previously made of the commission's disposition to deal fairly in matters within its scope. One of the incidental disclosures of the address was the corrective effect upon certain trade abuses of merely bringing them to the commission's attention—confirmation in a measure of what has been claimed for publicity as a curative.

Of most interest and significance was what Chairman Davies said of the sort of industrial preparedness with which this country must meet the competition to come from Europe after the war. Disagreeing with some of the easy optimism over this country's position that has emanated from Wash-

ington, he rates high the extent to which England, France and Italy, under the pressure of overpowering necessity, have specialized industry for greater economy and effectiveness. The reorganization of industry, when finally established in Europe, he points out, will represent a degree of efficiency that will command the respect of all rivals competing in the markets of the world. To meet this situation "will require that our industries be integrated and stabilized so that not only will the economies of sustained production be available, but it will require that the social well-being of the workers shall also be sustained upon a proper level to the same end."

That by "integrated and stabilized" industry he definitely means large business, the commission's chairman makes plain in saying later:

The economies of large-scale production to the extent that they exist, the advantages of integration of industry, the sustaining force of stabilization in industry, the prevention of feast and famine, the prevention of cutthroat competition, can all be encompassed in a democratic State without yielding to monopoly in principle or in effect. The problem of democracy is to conserve the efficiencies of industry to the highest degree that is compatible with the fundamental conception of liberty and freedom in industry. The problem of government is not only not to thwart efficiencies, but to stimulate them, to aid them, to develop them to the highest degree that is compatible with the general welfare. That is the problem for democracy. That is the great challenge that comes to this great republic with renewed insistence out of this epochal war.

Without forgetting that in times past fair words from official sources have given an encouragement to business that later proved unwarranted, it is to be noted that the chairman of the Federal Trade Commission has used almost in terms the reasons that have been urged for Government friendliness to big business. If that means, as it seems to mean, the sanction by the commission of the principle of co-operation, where it prevents cutthroat competition without leading to monopoly, it may be treated as assurance of more than ordinary significance in its bearing on both foreign and domestic trade.

Exports Still Break Records

According to the Bureau of Foreign and Domestic Commerce, Department of Commerce, our November exports of merchandise totaled \$331,144,527, exceeding all previous records for a month. The best previous record for November was in 1912, when the total was \$278,244,191. The im-

ports of merchandise in November amounted to \$164,319,169, thus leaving a balance of trade for that month in favor of this country of \$166,825,358. The total of imports and exports for the month fell but a little below \$500,000,000.

The total of imports and exports for the twelve months ended with November ran over \$5,000,000,000, greatly exceeding the foreign trade of any country in the world in any previous similar period. The balance of trade in favor of this country for the twelve months ended with November has run up to a staggering total, being \$1,707,049,304, against \$242,542,093 for the previous year and \$738,472,118 two years before.

If such a condition of our foreign trade could be realized with ocean shipping so inadequate that railroads running to our seaports are clogged with freight waiting to be unloaded, the question may well be asked, to what height would the figures rise if the flow of exports were unimpeded?

Are More Blast Furnaces Needed?

It is only very lately that pig iron has come to be considered a very important factor in the general iron and steel situation. In July and August, when the steel mills were speeding up to capacity operations and steel was beginning to grow scarce, there seemed to be no dearth of pig iron. The pinch seemed to be coming in steel rather than in pig iron. In many quarters such a development was rather unexpected, for in 1912 and 1913 there had appeared to be considerably more new construction in open-hearth steel than in blast furnace capacity. The sharp advances in the various pig-iron markets in the past few weeks have been strongly suggestive, however, of the possibility of a distinct shortage developing in pig-iron making capacity. Things have been changing so rapidly that it is impossible to gage accurately how the blast-furnace capacity in existence fits the steel-making capacity. A few months ago the production of shell steel, with its heavy discards from the ingot, constituted a larger proportion of the total output of steel than it does now and the quantity of scrap resulting was therefore important. Lately such high prices have been bid for scrap that a general clean-up of the scrap of the country is in progress. Later the supplies of scrap may be proportionately more limited and therefore correspondingly larger quantities of pig iron may be called for. The iron foundry industry, which customarily lags behind the steel industry in general revivals, and certainly has done so in the present instance, may possibly call for a much larger proportion of pig iron in the next few months than it has in the past few.

As the capabilities of the iron and steel industry as a whole may be found to rest chiefly or largely upon blast-furnace capacity, it may be well to consider the pig-iron situation more carefully than has been done in recent years. Whatever may be the tonnages of steel ingots produced from year to year, the production of finished merchantable steel runs after all rather closely parallel with the production of steel-making pig iron.

Since 1907 it has been customary to regard the old rule of pig-iron production doubling every ten years as something that has passed into history. No one has been optimistic enough to suggest the

possibility of the rule ever becoming operative again; but no fresh rule has been proposed to take its place. It may be well to recall how faithfully the rule worked in the past. The actual production of pig iron in the United States in decennial periods was as follows:

Ten Years Ended	Gross Tons
1837	2,000,000
1847	4,300,000
1857	6,500,000
1867	8,760,578
1877	19,984,735
1887	42,484,217
1897	82,236,958
1907	181,470,757

The maximum rate of production reached in the last decennial period was in October, 1907, 28,000,000 tons a year, and the actual production in the twelve consecutive months ended with that month was a trifle more than 27,000,000 tons. If one take a 28,000,000-ton rate for October, 1907, as a basis, and apply the rate of increase to date that would correspond with a doubling in a full period of ten years, the rate of output at present, eight years later, would be 48,750,000 tons. The actual rate, with the country doing its best or very nearly its best, is 38,000,000 tons. According to the old rule we are fully 10,000,000 tons short. One can make a comparison in the reverse direction, taking 38,000,000 tons for the present and working back eight years, which would give 21,825,000 tons as the rate that should have prevailed at the close of 1907.

The divergences thus suggested are so wide that it is not difficult to conceive the idea that the country is now, after all, short of pig-iron making capacity. That would be a condition not very promptly remediable. All steel works cannot easily be enlarged, but there are many that can. A few open-hearth furnaces may be added here and a few there. Room can be found for additional rolling mills in one place or another. A blast furnace, on the other hand, is a much more formidable undertaking, as the single unit is large, and a great deal of room is required for assembling and handling the bulky raw materials, the incoming raw materials and outgoing slag comprising a bulk between four and five times as great as the bulk of the product made.

The character of iron and steel demand at present is such as to make it quite impossible to estimate what proportion it bears to a normal prosperity demand. It is quite certain, however, that the country's growing requirements have not been properly expressed in actual orders during the past two years; but as regards the future there is an interesting comparison to be made. Assuming for argument that a normal prosperity demand was 28,000,000 tons at the end of 1907 and a corresponding demand at the present time, eight years later, is 38,000,000 tons, the average annual rate of increase has been 3.89 per cent. Such a proportionate increase, based on 38,000,000 tons, would now be 1,478,000 tons additional capacity per year. If a blast furnace produces 148,000 tons of pig iron a year and it requires one year to build it, we should have ten such stacks under construction all the time. The fact is that even to-day the country is not building blast furnaces at the rate that would maintain the moderate pace of increase that has obtained even since 1907.

Navy-Yard Shipbuilding Costs

Confirmation of the charge by shipbuilders that the Navy Department does not include all items of cost in its estimates of war-vessel construction is to be found in the forthcoming annual report by Rear Admiral R. S. Griffin, chief of the Bureau of Steam Engineering. In the course of his report he invites attention to the fact that navy-yard work on the design of machinery, especially where a number of different types of vessels is included in the building program, is seriously hampered by the limitation placed by Congress on the employment of technical men in the Bureau. On this subject he says:

The marked increase in types of vessels, as well as the number of vessels in the fleet, has greatly increased the work required to be done in the division of design of the Bureau, but much that it is desirable to do is left undone because of the inadequate force of skilled employees. A similar condition exists in the machinery division of the navy yards. The increase in the amount of new construction work that is now done entails a vast amount of drafting which the force heretofore employed is unable to cope with, and the only remedy is to increase the number of draftsmen, provision for which has been included in the estimates. While the cost of this additional drafting work should logically be lodged against the appropriation for building the vessels concerned, the law provides only for charging it against the current appropriation of the Bureau.

Rear Admiral Griffin has the proper idea of charging items of cost where they belong. A private shipbuilder would certainly charge the cost of drafting work against any vessel for which such work was intended. He would find it necessary to do this in endeavoring to arrive at a true approximation of the cost of that particular vessel. While it is a defect of the law, as enacted by Congress, that such cost is charged against the current appropriation of the Bureau of Steam Engineering, it is this very defect of the law which enables the Navy Department to underbid private shipbuilders in competing for Government orders for war vessels. This, and perhaps other items of a similar character, should be corrected by Congress, if only for the purpose of causing the Government officials to figure costs more closely. If members of Congress merely desire navy yards to be fully employed in building war vessels, that is another matter.

Private War Material Plants Should Be Kept Up

WASHINGTON, D. C., Dec. 28, 1915.—The policy which the Government should pursue in order to secure the highest measure of co-operation from private manufacturing concerns in the production of war material in an emergency is one of the features of the forthcoming annual report of Gen. William Crozier, Chief of the Ordnance Bureau of the War Department. His attitude will be fully appreciated by manufacturers in many industries in addition to those actually engaged in the production of war material. He calls attention to the fact that there is practically always going on a discussion of the proper policy to be followed by the Government in regard to the method of supply of its war material, and he expresses the opinion very emphatically that it should manufacture only that proportion of everything it uses, which is not a commercial product, as may be necessary to familiarize the officers of the Government with the material, to stimulate improvement, to enable them to fix standards and to

afford knowledge upon which the control of prices may be based. Continuing, he says:

I have considered that the extent to which the Government should manufacture its own material should be sufficient to permit the manufacture to be carried on by economical methods; but beyond this point I have favored the practice of employing the private industries of the country in order that these might be prepared to serve the Government's needs in case of emergency calling for greatly increased production, which would then be facilitated by the existence of a number of establishments possessing the initial installation and the technical knowledge required for rapid expansion, as well as by the reserve expansibility of the Government establishments employed normally at something less than their full capacity. A contrary policy has been followed, and practically all the appropriations of this department have been accompanied, in recent years, by legislation requiring that the material covered by these appropriations should be manufactured by the Government itself, in its own establishments, in some cases without condition, and in other cases under the condition that it can not be manufactured more cheaply by private manufacturers, exception being made with reference to a very limited expenditure for experimental purposes.

Under the stimulus of the European war a number of manufacturers in the United States have established plants, or enlarged existing ones, with a capacity of turning out, in some cases, very large quantities of material of the class for which the demand is greatest in war. Other manufacturers have prepared for the production in smaller quantities of such material, or of components entering it. This department has undertaken to inform itself in some degree as to the location and capacity of these plants for the manufacture of war material, and has received in response to inquiries gratifying statements as to the extent of output which might be expected and the willingness of the proprietors to operate their plants in the service of the Government. The accident of circumstances has thus temporarily removed a considerable source of anxiety, but there still remain some matters which should receive careful attention. The permanency of the relief effected is a matter of concern, and of anxiety as to the possibility of devising means for keeping in existence the plants which have been created under circumstances of slight Government patronage, or, if the present policy is to continue, of no such patronage at all.

W. L. C.

New Iron-Ore Sintering Plants

In view of the ore situation created by the unprecedented demand for pig iron, there is unusual interest now in the installation of plants for the conversion of fine ores and flue dust into readily usable form. At the blast furnaces of the Toledo Furnace Company, Toledo, Ohio, a two-machine plant of the American Ore Reclamation Company's Dwight & Lloyd system is nearing completion and will be in operation about Jan. 15. The latter company is also installing for the Virginia Iron, Coal & Coke Company a one-machine plant at its Radford, Va., furnace. This will be used primarily for treating flue dust. A contract has been closed with the Alan Wood Iron & Steel Company for a sintering plant at its two blast furnaces at Swedeland, Pa. This will be the third such installation in eastern Pennsylvania, the others being at the Brooke furnaces at Birdsboro and the Warwick furnaces at Pottstown.

An interesting Dwight & Lloyd installation now under way is a single-machine plant at the works of the Merrimac Chemical Company, North Woburn, Mass. This company has an accumulation of 75,000 tons of Rio Tinto pyrite cinder from which the sintered material made by the Dwight & Lloyd apparatus will run 65 per cent in iron, 0.010 in phosphorus. The construction work is in the hands of Stone & Webster, who have already completed the foundations.

The largest Dwight & Lloyd installation now in operation in the iron industry consists of four machines at the blast furnaces of the Jones & Laughlin Steel Company at Aliquippa, Pa. The accumulation of flue dust both from the Aliquippa and the Pittsburgh furnaces of the company amounts to nearly 1,250,000 tons.

Large supplies of anthracite coal are being accumulated at the mines in view of a possible suspension of mining at the expiration of the present wage agreement in the anthracite field March 31. The men demand an 8-hr. day, recognition of the union, 20 per cent increase in wages, abolition of the conciliation board, etc.

NO PIPE FREIGHT REPARATION

Rate Was Discriminatory, but the Shipper Was Not Damaged

WASHINGTON, D. C., Dec. 28, 1915.—That a freight rate may be declared discriminatory and unlawful but that the complainant shipper may not be awarded reparation because the damage, if any, has not been sustained by reason of actual competition, is the principle laid down by the Interstate Commerce Commission in its decision of the case of the United States Cast Iron Pipe & Foundry Company vs. Southern Railway Company et al., which has been pending for nearly four years. The complainant in this case is a corporation engaged in the manufacture and sale of cast-iron pipe, castings, etc., with its principal office at Burlington, N. J. It alleged that a rate of 75c. per 100 lb. charged by the defendant railroads for the transportation of 37 carloads of cast-iron water pipe and fittings from Anniston and Bessemer, Ala., to El Segundo, Cal., during the period from Aug. 1 to Dec. 10, 1911, inclusive, was unduly prejudicial and unreasonable to the extent that it exceeded 65c. per 100 lb.

Cast-iron water pipe and fittings are manufactured in the Philadelphia and Pittsburgh, Pa., districts and in the Buffalo, N. Y.; Cleveland and Cincinnati, Ohio; Lynchburg, Va.; Anniston and Bessemer, Ala., districts. Manufacturers located in these districts compete in the Pacific coast markets, and prior to July 31, 1911, the rate to El Segundo from all of these districts was 75c. per 100 lb., composed of the Pacific coast terminal rate of 65c. to Los Angeles, Cal., and a rate of 10c. beyond. El Segundo is 17 miles west of Los Angeles on a branch line of the Atchison, Topeka & Santa Fe Railway from Los Angeles to Redondo, Cal. On July 3, 1911, the Santa Fe instructed the joint agent issuing the transcontinental tariffs to publish the same rates to El Segundo and other stations on the Redondo branch as to Pacific coast terminals. Pursuant to these instructions a rate of 65c. per 100 lb. on cast-iron pipe and fittings was made effective July 31, 1911, by the special permission of the commission from all of the above-named producing districts except Anniston and Bessemer. The 65-c. rate was not established from Anniston and Bessemer until Dec. 11, 1911, because of objections interposed by the lines serving those points. A number, if not all, of the carriers defendant that participated in the 75-c. rate from Anniston and Bessemer also participated in the 65-c. rate contemporaneously in effect from the competing producing districts named. Defendants deny that the 75-c. rate was unreasonable, but the Santa Fe, which was the only carrier represented at the hearing, conceded that the maintenance of a higher rate from Anniston and Bessemer than from competing points of production in the East discriminated against complainant.

The commission holds that a through rate from Anniston and Bessemer to El Segundo of 75c. cannot be condemned as unreasonable, but that the defendants' failure to maintain during the period in question the previous parity of rates between the Anniston and Bessemer districts and competing districts in the East discriminated against the complainant unjustly. It does not appear, however, the commission says, that the complainant was damaged by the discrimination. The pipe was sold f.o.b. destination, and the payment of the 75-c. rate reduced complainant's prevailing "shop" or net price of the material approximately \$2 per ton; but it does not appear that the selling price was affected in any way by competition with manufacturers located at points from which the 65-c. rate applied. On the contrary, it appears that a rate of 65c. was employed in fixing the selling price solely because complainant had been advised by the carriers that such a rate would be published.

W. L. C.

The Bureau of Railway News and Statistics says that the gross earnings of the railroads in October, about \$313,000,000, were \$7,000,000 greater than the previous record month, October, 1912.

CONTENTS

Minnesota Steel Company Completes Plant.....	1507
Substitute for Sulphuric Acid in Pickling.....	1519
New Oxygen Generator.....	1520
New Holder for Spring or Prong Dies.....	1521
Truck with Special Lowering Device.....	1521
Lifting Magnets with Increased Capacity.....	1521
Shop Pneumatic Devices Which Effect Great Savings..	1522
New Cutting Oil and Compound Filter.....	1523
Collet Holder for Spring Dies.....	1523
Ornamental Wire Fence Machine.....	1524
Threading Die with Adjustable Chasers.....	1524
The Price of Castings.....	1525
Bulb Angles and Beams for Shipbuilding.....	1525
Business and the Trade Commission.....	1526
Exports Still Break Records.....	1526
Are More Blast Furnaces Needed?.....	1527
Navy-Yard Shipbuilding Costs.....	1528
Private War Material Plants Should Be Kept Up.....	1528
New Iron-Ore Sintering Plants.....	1528
No Pipe Freight Reparation.....	1529
Brier Hill Will Build By-Product Coke Ovens.....	1529
Lehigh Benzol Plant to Be Doubled.....	1529
Educating Workers for Higher Efficiency.....	1530
The Manufacture of Belting.....	1533
Copper Exports and the War.....	1533
The Iron and Metal Markets.....	1534
Emergency Shipping of Motor Trucks.....	1544
By-Product Coke Plant at Cleveland.....	1547
Prohibition of Scientific Shop Management at Army Arsenals.....	1547
British Steel Exports.....	1547
Railroad Car Business.....	1547
Ferromanganese Imports in November.....	1547
Large Midvale Contract for French Shells.....	1548
Pittsburgh and Nearby Districts.....	1548
Personal.....	1548
Locomotive and Car Orders.....	1549
Larger British Imports of Manganese Ore.....	1549
American Semi-Finished Steel in Great Britain.....	1549
American Tin-Plate Exports.....	1549
Better Relations Between Railroads and Patrons.....	1549
Obituary.....	1550
Magnetic Clutch-Brake Used with 650-Hp. Motor.....	1550
The Effect of Sulphur on Cast Iron.....	1551
Consolidation of Foundry Equipment Companies.....	1552
Germany's Accumulated Supply of Ferromanganese.....	1552
An Alloy Steel of Special Composition.....	1553
Bonuses to Employees.....	1554
Associate Members Pro Tem.....	1554
Machinery Markets and News of the Works.....	1555
Bulldozer Exerting 500 Tons Pressure.....	1560
Bench Milling Machine for Small Parts.....	1560
Heavy Damages on Unfilled Machine Contract.....	1560
Hydraulic Scrap Compressing Machine.....	1561
The Pittsburgh Foundrymen's Association.....	1561
New Trade Publications.....	1562

Brier Hill Will Build By-Product Coke Ovens

The board of directors of the Brier Hill Steel Company, Youngstown, Ohio, has authorized the building of a by-product coke oven plant at its Brier Hill furnaces. Details have not been definitely decided, but the ovens will probably be Koppers, and the number will be 80 to 90, or sufficient to make 1000 tons of coke per day to cover the requirements of the company's blast furnaces. It is also the intention to issue new stock, probably \$5,000,000 or \$10,000,000, the exact amount not having yet been settled. The company will also build additional finishing mills or work out some other plan that will take up more of its output of semi-finished steel. From \$2,000,000 to \$2,500,000 will be spent on the coke ovens and other additions. The annual meeting of stockholders, to be held Jan. 25, will consider the proposition of increasing the capital stock.

Lehigh Benzol Plant to Be Doubled

Carl Still, Farmers Bank Building, Pittsburgh, has been awarded a contract for the extension of the benzol plant now under construction for the Lehigh Coke Company, South Bethlehem, Pa. The plant now under construction is capable of handling gases from 3000 gross tons of coal daily, and after completion of the extension it will be capable of working up benzol and its homologues from the gases of 6000 gross tons daily.

Educating Workers for Higher Efficiency*

Motion Study, Time Study, Chronocyclegraphs
and Other Methods of Transferring Skill All
Have Their Place in Educating Workmen

—BY F. B. AND L. M. GILBRETH†—

Scientific management abandons no successful method of teaching used by the older types, nor does it contemplate relieving the public schools of their responsibility of teaching and preparing the workers. All the good ideas of whatever sort of every member of the organization are conserved and gathered together in the standard instructions. All the talent discovered in members of the organization who have operated under the older types of management is utilized to teach the learners under the new type. Besides the more or less directive and systematic teaching of the old type of management, and the teaching done by the "systems" under transitory management, scientific management teaches by means of textbooks in the form of "instruction cards," standing orders, standards, object lessons, and through the functional foremen. These last can more truly be called teachers. As has been already explained, the success of all parts of scientific management depends upon the success of the teaching. Motion study probably has brought out more clearly than has any other branch of the science of management the necessity of standardizing the best of the present methods for the transference of skill, if the best results are to be obtained.

THE INSTRUCTION CARD

The instruction cards form a large element in this transference of skill. They consist of anything which may be used as a standard conveyor of information from one who knows to one who is learning. They contain, besides information as to how the work is to be done, data as to the time the work is supposed to consume, how the largest out-

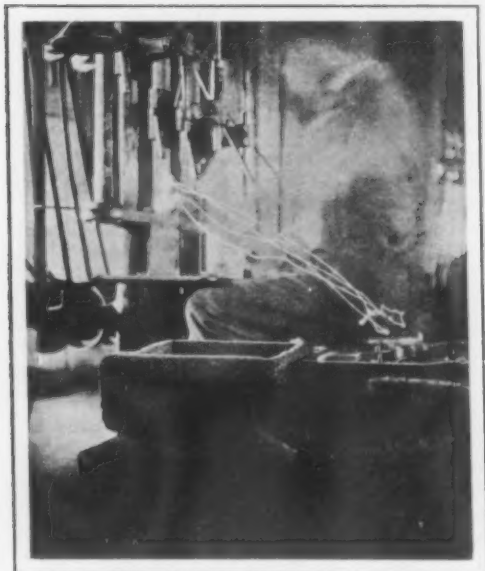


Four Wire Models of Motion Studies Indicating Improvements Made Through Such Study

Some idea of how a micromotion study may be made may be gained from the accompanying reproduction of a photograph made for use in the



stereoscope. The picture shows the subject of the automatic self-micromotion study turning on the speed regulator for the motion picture machine employed.



Chronocyclegraph of Operations at a Drilling Machine

put can be achieved with the least fatigue, and various other data that are not of importance here. In some forms of work, the instructions as to methods consist merely of printed directions which describe these methods in greater or less detail. To these may be added sketches, drawings, blueprints, or anything which will make it easier for the learner to grasp what he is expected to do.

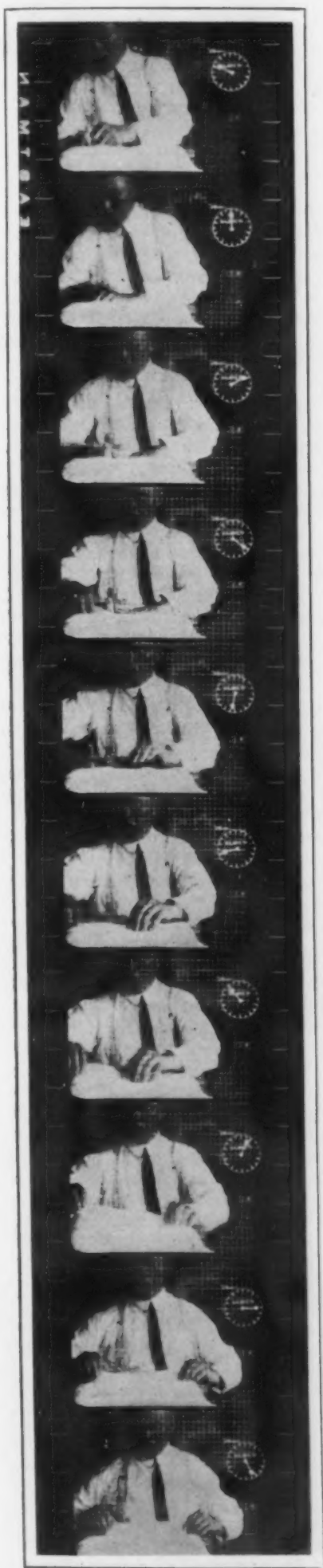
The methods of instruction vary not only with the type of work, but more especially with the type of learner. In cases where the learner and teacher spoke different languages, working exhibits have been used with great success. In similar manner, demonstrations, or complete stage-by-stage layouts of the work to be done have answered the same purpose. As each new discovery of efficient apparatus for carrying on the science of management is made, the results are immediately incorporated in the instruction card and become a part of the educational force of the organization.

MOTION PICTURE FILM FOR INSTRUCTION

The micromotion picture film records most efficiently the best motions of the most accomplished worker whose method it has been found, by meas-

*Copyright, 1915, by F. B. and L. M. Gilbreth.

†Consulting Engineers, Providence, R. I.



Micromotion study with penetrating screen in the plane of the motions, the film having been run through first for photographing the screen and then for the motions in the plane of the screen

urement, to be most desirable to standardize. It forms an excellent instruction card, and is being used with great success. These micromotion films may be used in various ways. The film may be given to the worker, who may study it through a magnifying glass, or through a simple device by which it is held and enlarged. The data upon it may then easily be read. If the worker is of a type to whom printed instructions in addition to the photographic record would convey more information as to what he is to do, prints may be made from the film and used to illustrate the various printed directions of the instruction card.

The cyclegraph also has been used as an effective instruction card. In some cases, where the learner is a good visualizer, stereoscopic photographs of the standard cycles will answer for nearly all purposes of instruction. In other cases, where the learner depends more upon his motor senses than upon his eyes, a wire model of the cycle will bring him closest to the realization of the path that the efficient motion must traverse.

It is often a revelation to the worker when he comes to understand the real reason why he is motion-studied or time-studied. If he has had no training in motion study, and especially if he has heard those who condemn it without having had the opportunity to understand its workings, he is apt to suppose that the object of motion studies and time studies is, at best, to find the shortest time in which a piece of work can be done, and to insist that the work be done within that time limit every time. Also, he may believe that it is a method of "stealing the worker's skill" without paying anything for it.

MOTION STUDY DOES NOT STEAL WORKMAN'S SKILL

As an actual matter of fact, the real aim of motion study and time study is to determine exactly how a given piece of work can be done with the least amount of fatigue, and, to eliminate the greatest possible amount of human effort and other waste. In no way does it steal the skill of the workman. On the contrary, gives him more skill than is possessed by the best workman. Motion study aims to discover and standardize the paths of greatest efficiency. Time study is the most effectual method of testing the various paths and of discovering whether the resultant path to be standardized is really the shortest in point of time or not.

Another purpose of time study is to have a fair and honest basis for giving the worker the same earning rate when the method of producing the piece is changed to one that requires less (or more) time to complete; for example, as when a new device or machine is installed to do a part of the work.

Motion study and time study result in less fatigue for the reason that the work is done in the shortest time possible, practically every time. The worker is not forced to do it within that time. He does the work by the most efficient and least fatiguing method, and therefore can easily keep within the expected time limit. If the standard conditions are maintained and he cannot comfortably keep within this time limit after sufficient practice, one of two things is true. Either he has not been properly taught the method that has been standardized, or he is a type of man not suited to the work. In the latter case he should, for his own benefit, be transferred to some type of work for which he is better suited.

An important part of the training of each member of the organization is the understanding of the reasons for and the methods of making motion study and time study. Until the man has been so

trained, he does not understand the "why" of these methods of measurement. Unless he asks that his methods be submitted to the tests of time and motion study, or at least willingly consents he should never be subjected to them. In actual practice, in the case of some old-time, extremely conservative members of the organization, a considerable period will elapse before they appreciate the value of these methods of measurement. Never, so far as the knowledge of the present writers extend, has any such conservative individual been subjected to these methods, either without or with his knowledge. Such cases are rare, but it is a test of the humanity of the science of management that it can, and has, treated such cases as they deserve—with tolerance and respect.

VISUALIZING DEVICES FOR THE WORKER

A new form of teaching the worker has been devised by us recently. It is an adaptation of many of the visualizing devices used by the plant, of such a nature that these can be taken by the workers or the department heads, or by any one in the organization who is interested—to their homes. One such adaptation is, for example, a small, thin, portable box, 11 by 18 in., full of shelves, that represents a small route model. This may, perhaps, have simply one shelf, representing one floor, if the man who wishes to study it is interested particularly in the routing of that one floor, or it may have enough shelves to cover whatever portion of the plant that particularly interests him. Another such adaptation is the reproduction on a hectograph of the floors and the path strings representing the course of the product through the plant, the path strings being represented by threads or various colored inks. Stereochronocyclegraphs have also been used with satisfactory results. Such devices educate the man himself in motion study and transportation in paths of least waste. They also cause the beginnings of thinking in terms of motion elimination and educate his entire family and circle of friends, and arouse in them an interest in his welfare and in his work.

HOME READING BOX MOVEMENT

This is not the only attempt to carry the education in elimination of waste motion into the homes of the workers. For example, it is customary for the engineers of the establishment who visit the meetings of the various engineering, trade and commercial societies, to send copies of the various papers there available to the foremen and men in the organization who are particularly interested in the lines of work presented. These papers become, in most cases, the property of the individuals to whom they are sent, and not the property of the organization, and are often the initial cause of starting individual libraries in the homes of the workers. So also trade catalogs, that may or may not prove of temporary use to the various heads of departments, are, as soon as these heads have finished with them, passed on to other members of the organization who may be interested.

This is done systematically by means of our home reading box,* for, while its first purpose, and the product that was expected through it, was the education of every member of the organization, the by-product has, perhaps, proved even more important; that is, its effect upon the spirit of co-operation. It is necessary only to say here that the home reading box movement is a box or station in the plant into which all literature of any kind with which any member of the organization has finished is placed. It is removed by any other member of the organization who may find it interesting or

useful. He returns it later, passes it on to his neighbor who has no such opportunity to obtain reading matter, or keeps it according as he desires it for temporary or permanent use.

WEEKLY MEETINGS

Another means of educating the organization is found in the various types of meetings or "smoke talks" held during and after the period of installation of the new methods. We have held these meetings since 1901. Much benefit will be derived by holding meetings, preferably weekly, open to the entire organization. These are addressed in the beginning by the man in charge of the installation or some of his assistants, but are presided over by various members of the organization. They are open for discussion and questions from all. Such meetings have been attended by a large percentage of the members of an organization, in all lines of work. They have resulted not only in spreading a knowledge of the aims of the science of management, but also have had a beneficial influence in obtaining the spirit of hearty co-operation.

Clubs, also, are usually formed among those members of the organization who are drawn together by some common interest. Such is the "Foremen's Club" that takes up problems of teaching and of directing, and of waste elimination in general. Such also are Mutual Benefit Clubs of various kinds, that are found carried over from some old type of organization, and that are never abolished, but are often taught better principles of co-operating.

INCENTIVES FOR TEACHING AND MAINTAINING METHODS

The above are, in general, some of the many methods of education used in scientific management. As to the incentives toward education, particularly the incentives for teaching, these have been fairly well outlined in the discussion of promotion,† where it was brought out that every man's rise depends very largely upon his training those who are successively to occupy the position that he is leaving. There are other forms of incentives that would come under pay. Such are the interdependent high rates, typical of which is the high rate earned by the foreman when every man whom he is supposed to teach has been properly taught and is earning his bonus. Another example is the additional bonus that the helper gets when his mechanic gets a bonus.

As for methods of maintaining this standard of education, these are of various kinds. They depend upon whether or not the science of management is a new thing in the plant, or has become well established. They also depend upon whether the work done in the plant is of the same type continually, or whether new sorts of work are being successively introduced. The standard instruction card and the interdependent high rates must be in constant use in every type of plant; but the amount of teaching that the functional foremen will find it necessary to do, and the extent to which the instruction card must be elaborated, illustrated, or demonstrated will vary with the conditions. The more social types of education, such as the Home Reading Box, and the meetings of the various types of clubs, will, of course, exist at all times, and under all conditions.

THE EFFECT OF EDUCATION

The effect of all these methods of education upon the individual is not only to increase his store of knowledge, but, more important still, to teach him how he himself can increase this store; to teach him a better method of attack upon any problems that may face him; and to teach him to think

*Described in brief in THE IRON AGE, Apr. 16, 1914.

†THE IRON AGE, Nov. 4, 1915.

in terms of measurement of units that are more nearly elementary. If the principles that underlie education are carried out as they should be, not only will the organization itself increase in efficiency, but each individual should see an improvement in himself. The various elements that enter into the results might, perhaps, be illustrated through four of the slogans that have been coined in connection with motion study:

1. "Every little motion has a meaning of its own."
2. "Count each motion, make each motion count."
3. "Make each motion of the working period bring you money."
4. "Make each motion of your work help bring you that which you most desire."

The first of these brings out the significance of the units measured in themselves. The second brings out the importance of each individual becoming himself a measurer in order that he may best utilize his energies. The third brings out the fact that every efficient performance of the period of activity brings direct financial gain, and implies that the period for recuperating from fatigue should be spent in rest. The fourth, and perhaps the most attractive, brings out the fact that efficiency can and does result in increased general prosperity, and that this prosperity goes largely to the man who is efficient. It is this feeling that results from the type of education that is a part of the science of management, and the effect of it upon the individual, the group, and society that forms an important element in the final outcome of the introduction of the science of management that must be considered in the final discussion to come later.

THE MANUFACTURE OF BELTING

Various Steps in Converting Hides into Leather for Power Transmission

The essential qualities of leather belting as given by F. H. Small, chemist of the Graton & Knight Mfg. Company, Worcester, Mass., in a paper presented at a meeting of the Providence Association of Mechanical Engineers, Sept. 22, 1915, are great driving surface with sufficient friction between belt and pulley to eliminate slippage as nearly as possible, lateral stiffness coupled with pliability, good tensile strength, little stretch but considerable elasticity, stability, resistance to external conditions such as heat, moisture, chemicals, etc., and low initial cost. The paper describes the various processes by which hides from the farms of New England, the grazing ranges of the Argentine, the rocky Alpine pastures of Switzerland and the fertile plains of France are converted into leather belting.

After discussing the evils with which the tanner has to contend, such as barbed wire, brands, grubs and cuts in the hide, the various methods of tanning employing grease, a mixture of alum and salt, salts of chromium or a tannin derived from some vegetable material, such as the bark of hemlock, oak, chestnut, valonia, myrobalans, mimosa or quebracho trees or some other of the twenty-five or thirty materials commercially available, are described. When the hide has been tanned approximately only 50 per cent of it is cut into belting, the remainder being the bellies and the shoulders which are not suitable for this purpose. The portion remaining after the cropping process is technically termed a "bend" and is curried or given a supplementary grease tannage, set out to give a smooth, flat piece of leather and stretched. After the stretching process is completed, the leather is rolled and glassed to improve its looks and sent to the stockroom. There the leather is sorted according to its weight into square piles with alternate layers at right angles to keep the stock flat and straight and allow a circulation of air through the pile, thus aiding and hastening the seasoning process.

From the stockroom the leather goes to the belt shop where the first step is to straighten one edge of the leather. It is next cut into strips of various widths by passing between a rapidly revolving circular knife and a guide, the strips being graded for width and roughly for quality as they come from the knife and stored in racks. From the racks the leather goes to the sorters who grade it both for thickness and quality. After the strips have been sorted they go to the fitters to be matched and to have the laps marked. Pieces cut from the right side of the hide are matched with others cut from the left side because all strips which are not the backbone center pieces will stretch in a curve if subjected to sufficient strain. Narrow strips from a properly stretched side contract to a slight curve, merely as the result of the stripping, and belts made by joining alternately right and left strips will roll out in a curve on the floor, but will run true upon the pulleys.

The laps are marked according to the thickness of the stock and usually range between 4 and 10 in. in length. The laps must be longer on the shoulder end of the piece because the hides taper off faster near the shoulder than the rump and longer laps are needed to maintain a uniform thickness of belt. Shoulder ends are joined to shoulder ends and butts to butts, because the length of the laps match better and the thickness is more uniform. The laps are next scarfed and prepared for cementing, the usual material employed having animal glue for its base. The surfaces of the leather to be joined are covered with the cement, put together in final position and placed between the plates of an hydraulic press and subjected to heavy pressure. For the most part waterproof cement is used and laps stuck with this are unaffected by water either hot or cold. From the presses the belt goes to the inspector and then to stock.

While this description applies more particularly to single belting, the processes are much the same if double or three-ply belting is to be made. After the stock has been prepared it is placed upon a fitter's bench, where the pieces are matched together on a smooth surface against wooden blocks that are the standard of thickness. As far as possible the pieces are matched to secure uniform thickness and to make the laps of one ply come about halfway between those of the adjacent one.

Copper Exports and the War

Notwithstanding that Germany before the war took nearly one-third of the copper exports from the United States, the present outgo is large. The following table from Government data shows these exports:

	1913, Pounds	1914, Pounds	1915, Pounds
July	72,823,160	46,867,802	
August	38,293,558	37,238,284	
September	44,460,941	49,453,987	
Nine months ended Sept. 30	698,383,592	667,641,879	482,697,193
Year ended June 30	845,532,387	974,291,676	677,303,822

The change in the destination of these exports is shown by the following comparative table, covering the first nine months of 1913 and 1915:

	1913, Pounds	1915, Pounds
Austria-Hungary	27,598,218	
Belgium	5,441,723	
France	117,062,152	156,132,907
Germany	228,663,245	
Italy	31,770,335	73,909,262
Netherlands	137,821,261	2,261,194
Russia in Europe	6,282,693	34,965,654
United Kingdom	101,799,486	156,944,351
Other Europe	9,363,007	38,971,043
Canada	27,947,097	15,900,591
Other countries	3,633,775	5,612,101

The large increase to Italy, France, Russia and Great Britain is due to war needs. The decided decrease in exports to Holland represents the cessation of shipments for Germany to Antwerp.

The Buckeye Engine Company, Salem, Ohio, control of which was recently acquired by Edwin S. Griffiths, Cleveland, has secured an order amounting to about \$400,000 for presses. This order was taken by Mr. Griffiths in the East a few days ago and it is understood the machines will be used in the manufacture of shells.

The Iron and Metal Markets

HOME BUYING NOT HEAVY

Tin Plate Advances to \$3.75 per Box

A 5-Cent Reduction in Old-Range Lake Ores— High Prices for Vessel Steel

The British and French governments and their New York agents are putting forth every effort to get vessels to New York to help break the deadlock in steel and munitions shipments, but the situation is full of uncertainty. Meanwhile the steel companies are turning some mills to home orders on which there has been great pressure for shipments.

Generally new buying of finished steel for domestic use has quieted down, and there is satisfaction at this, as the feeling has been growing that price advances have gone beyond safe bounds. Lake shipyards, for example, see a check to vessel building in a 1.80c. basis for plates, which means that an ore carrier costs \$60,000 more than when plates are 1.05c., as at the beginning of the year. Two sales of 10,000 tons each of plates and shapes for vessels are reported at 1.90c., Pittsburgh, for delivery in the third quarter.

Mill schedules have had a minimum of holiday interruption, in contrast with conditions one year ago. The export embargo caused some holding up earlier, and this is one factor in the considerable increase in unfilled orders expected in the Steel Corporation's statement.

The railroad embargoes on iron and steel and coke have crippled a number of New Jersey and New England foundries. In Connecticut several foundries have shut down for lack of coke. In other cases foundries have been forced to buy prompt pig iron at high prices from furnaces on railroads which are still accepting pig iron.

Estimates of the scale on which war steel will be bought next year grow rather than diminish. France has ordered from the Midvale Steel Company 384,000 8.8 to 11.8-in. shells, while heretofore only rounds and billets have been bought here. An inquiry for 33,000 net tons of rounds for France has brought out a 2.90c. price. Another lot of 80,000 tons for export is pending in New York.

Barb wire for France is again in demand on a large scale, about 30,000 tons being bought this week, much of it at 3.25c.

The rail mills of the Steel Corporation are now sold up to October, 1916. The Southern Railway has placed 23,000 tons, of which 12,000 tons will be rolled at seaboard. The same mill has taken 15,000 tons for the M. K. & T., which earlier bought 15,000 tons. The Texas & Pacific has bought 7000 tons from the Tennessee Company, and the Lackawanna Steel Company has booked 4000 tons for the International Railway at Buffalo, 4000 tons for the Cuban Railways, 5000 tons for the Burlington, and 3000 tons for the International & Great Northern.

Tin plate has advanced 15c. a box to \$3.75 and several round sales have been made on the new basis. Export tin plate was sold as high as \$3.80. Demand has been coming on a large scale

from the Far East, and contracts have been made with consumers there running through 1916. Welsh tin-plate makers are much concerned over the loss of much of their export trade to the United States. Regarding tin supply and prices the Suez Canal situation presents possibilities that are not entirely overlooked.

The foundry pig-iron situation is stronger and there has been considerable buying in spite of the holidays. At Buffalo the greater part of the 75,000 tons of resale iron that has been a factor in that market has been disposed of. Southern iron is for the most part on a \$15 basis or higher.

Canada in an order of Dec. 27 has prohibited the shipment of steel scrap to this country. In view of the large amount of steel sent from this side to Canadian munitions plants, a modification of the order will be asked for by shippers of this steel who have been importing Canadian scrap.

Lake Superior old-range ores have been reduced 5c. a ton from the opening price, making Bessemer ore \$4.45 and non-Bessemer ore \$3.70. It has developed that one firm made opening sales at 70c. advance upon last year's prices and other sellers who secured an advance of 75c. have now revised their contracts.

The possibility of all-rail shipments of Lake Superior ore to Ohio furnaces before navigation opens has been discussed in view of the short supply at some furnaces. Ore interests look for no such shipments except in a possible emergency calling for a small amount of a special ore. The freight is practically prohibitive; further, nearly 9,000,000 tons was on Lake Erie docks Dec. 1.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type. Declines in Italics

At date, one week, one month, and one year previous

	Dec. 29, 1915.	Dec. 22, 1915.	Nov. 24, 1915.	Dec. 30, 1914.
Pig Iron, Per Gross Ton:				
No. 2 X, Philadelphia...	\$19.50	\$19.50	\$17.75	\$14.25
No. 2, Valley furnace...	18.50	18.50	16.00	13.00
No. 2 Southern, Cin'ti...	17.40	17.40	16.40	12.40
No. 2, Birmingham, Ala.	14.50	14.50	13.50	9.50
No. 2, furnace, Chicago*	18.50	18.00	17.50	12.75
Basic, del'd, eastern Pa.	18.50	18.50	17.50	13.50
Basic, Valley furnace...	18.00	18.00	16.00	12.50
Bessemer, Pittsburgh...	20.45	19.95	17.95	14.70
Malleable Bess., Ch'go*	18.50	18.50	17.50	12.75
Gray forge, Pittsburgh...	18.20	18.20	16.45	13.45
L. S. charcoal, Chicago...	19.25	19.25	17.25	15.75

Billets, etc., Per Gross Ton:				
Bess. billets, Pittsburgh...	32.00	32.00	28.00	19.00
O.-h. billets, Pittsburgh...	33.00	33.00	29.00	19.00
O.-h. sheet bars, P'gh...	35.00	35.00	29.00	20.00
Forging billets, base, P'gh	55.00	52.00	50.00	24.00
O.-h. billets, Phila.	40.00	40.00	35.00	21.40
Wire rods, Pittsburgh...	40.00	40.00	38.00	25.00

Finished Iron and Steel,				
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.25	1.25	1.25	1.25
Iron bars, Philadelphia...	2.059	2.059	1.859	1.17 1/2
Iron bars, Pittsburgh...	1.80	1.80	1.65	1.15
Iron bars, Chicago...	1.75	1.75	1.60	0.95
Steel bars, Pittsburgh...	2.00	2.00	1.70	1.05
Steel bars, New York...	2.169	2.169	1.869	1.21
Tank plates, Pittsburgh...	2.25	2.25	1.90	1.05
Tank plates, New York...	2.419	2.419	2.169	1.21
Beams, etc., Pittsburgh...	1.90	1.90	1.70	1.05
Beams, etc., New York...	2.069	2.069	1.869	1.21
Skelp, grooved steel, P'gh	1.70	1.70	1.70	1.10
Skelp, sheared steel, P'gh	1.80	1.80	1.80	1.15
Steel hoops, Pittsburgh...	2.00	2.00	1.75	1.20

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Sheets, Nails and Wire,	Dec. 29, 1915.	Dec. 22, 1915.	Nov. 24, 1915.	Dec. 30, 1914.
	Cents.	Cents.	Cents.	Cents.
Per Lb. to Large Buyers:				
Sheets, black, No. 28, P'gh	2.50	2.50	2.40	1.80
Galv. sheets, No. 28, P'gh	4.75	4.75	4.25	2.75
Wire nails, Pittsburgh....	2.10	2.10	1.90	1.50
Cut nails, Pittsburgh....	1.90	1.90	1.85	1.50
Fence wire, base, P'gh....	1.95	1.95	1.75	1.30
Barb wire, galv., P'gh....	2.95	2.95	2.75	1.90

Old Material, Per Gross Ton:

Iron rails, Chicago....	16.00	16.00	16.00	11.25
Iron rails, Philadelphia....	19.50	19.50	17.50	13.00
Carwheels, Chicago....	14.75	14.50	14.50	9.75
Carwheels, Philadelphia....	16.00	16.00	14.00	10.50
Heavy steel scrap, P'gh....	17.50	17.50	17.00	11.25
Heavy steel scrap, Phila....	16.00	16.00	14.75	9.50
Heavy steel scrap, Ch'go....	16.00	15.75	15.00	8.75
No. 1 cast, Pittsburgh....	15.25	15.25	14.00	11.25
No. 1 cast, Philadelphia....	16.75	16.75	14.50	11.75
No. 1 cast, Ch'go (net ton)	13.75	13.75	13.00	9.25

Coke, Connellsville,

Per Net Ton at Oven:				
Furnace coke, prompt....	\$3.00	\$3.25	\$2.10	\$1.50
Furnace coke, future....	2.40	2.40	2.35	1.75
Foundry coke, prompt....	3.25	3.25	2.75	1.90
Foundry coke, future....	3.00	3.00	3.00	2.15

Metals,

Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York....	22.25	20.25	19.87 1/2	13.50
Electrolytic copper, N. Y.	22.25	20.25	19.87 1/2	13.00
Spelter, St. Louis....	17.25	17.25	18.75	5.40
Spelter, New York....	17.50	17.50	19.00	5.55
Lead, St. Louis....	5.32 1/2	5.30	5.17 1/2	3.82 1/2
Lead, New York....	5.40	5.40	5.25	3.80
Tin, New York....	39.25	39.50	39.25	32.25
Antimony, Asiatic, N. Y.	39.50	39.00	39.50	14.00
Tin plate, 100-lb. box, P'gh.	\$3.60	\$3.50	\$3.40	\$3.10

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 73.9c. on plates, structural shapes and sheets and 65c. on wrought pipes and boiler tubes. The foregoing rates to the Pacific coast are by rail. The rate via New York and the Panama Canal is 56.9c.

Plates.—Tank plates, 1/4 in. thick, 6 1/4 in. up to 100 in. wide, 1.90c. to 2.25c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated Feb. 6, 1903, or equivalent, 1/4 in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft. are considered 1/4-in. plates. Plates over 72 in. wide must be ordered 1/4 in. thick on edge or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft. down to the weight of 3/16 in. takes the price of 3/16 in.

Allowable overweight, whether plates are ordered to gage or weight to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras	Cents per lb.
Gages under 1/4 in. to and including 3/16 in....	.10
Gages under 3/16 in. to and including No. 8....	.15
Gages under No. 8 to and including No. 9....	.25
Gages under No. 9 to and including No. 10....	.30
Gages under No. 10 to and including No. 12....	.40
Sketches (including straight taper plates), 3 ft. and over.....	.10
Complete circles, 3 ft. in diameter and over.....	.20
Boiler and flange steel.....	.10
"A. B. M. A." and ordinary firebox steel.....	.20
Still bottom steel.....	.30
Marine steel.....	.40
Locomotive firebox steel.....	.50
Widths over 100 in. up to 110 in., inclusive.....	.05
Widths over 110 in. up to 115 in., inclusive.....	.10
Widths over 115 in. up to 120 in., inclusive.....	.15
Widths over 120 in. up to 125 in., inclusive.....	.25
Widths over 125 in. up to 130 in., inclusive.....	.50
Widths over 130 in.....	1.00
Cutting to lengths under 3 ft. to 2 ft., inclusive.....	.25
Cutting to lengths under 2 ft. to 1 ft., inclusive.....	.50
Cutting to lengths under 1 ft.....	1.55
No charge for cutting rectangular plates to lengths 3 ft. and over.	

Wire Products.—Prices to jobbers: Fence wire, Nos. 0 to 9, per 100 lb., terms sixty days or 2 per cent discount in ten days, carload lots, annealed, \$1.95; galvanized, \$2.65. Galvanized barb wire and staples, \$2.95; painted, \$2.25. Wire nails, \$2.10. Galvanized nails, 1 in. and longer, \$2 advance over base price; shorter than 1 in., \$2.50 advance over base price. Woven wire fencing, 67 1/2 per cent off list for carloads, 66 1/2 off for 1000-rod lots, 65 1/2 off for less than 1000-rod lots.

The following table gives the price per 100 lb. to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Nos.	Plain Wire, per 100 lb.							
	0 to 9	10	11	12	12 1/2	13	14	15
Annealed	\$2.00	\$2.05	\$2.10	\$2.15	\$2.20	\$2.25	\$2.30	\$2.35
Galvanized	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25

Wire Rods.—Bessemer, open-hearth and chain rods, \$40, nominally.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, 1/4 in. thick and over, and zees 3 in. and over, 1.80c. to 2c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.....	.10
H-beams over 18 in.....	.10
Angles over 6 in., on one or both legs.....	.10
Angles, 3 in. on one or both legs less than 1/4 in. thick, as per steel bar card, Sept. 1, 1909.....	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail).....	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909.....	.20 to .80
Deck beams and bulb angles.....	.30
Handrail tees.....	.75
Cutting to lengths under 3 ft. to 2 ft. inclusive.....	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive.....	.50
Cutting to lengths, under 1 ft.....	1.55
No charge for cutting to lengths 3 ft. and over.	

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from Aug. 16, 1915, on steel and iron galvanized pipe, and from Nov. 1, 1915, on steel and iron black pipe, all full weight:

Butt Weld			
Inches	Steel	Black	Galv.
1/4, 1/2 and 3/4.....	71	46 1/2	63
1 1/2.....	75	59 1/2	63
1 1/2 to 3.....	78	63 1/2	67
Lap Weld			
2.....	75	60 1/2	66
2 1/2 to 6.....	77	62 1/2	66
7 to 12.....	75	58 1/2	66
13 and 14.....	61 1/2	..	68
15.....	59	..	68
Reamed and Drifted			
1 to 3, butt.....	76	61 1/2	68
2, lap.....	73	58 1/2	68
2 1/2 to 6, lap.....	75	60 1/2	68
Butt Weld, extra strong, plain ends			
1/4, 1/2 and 3/4.....	66	49 1/2	60
1 1/2.....	71	58 1/2	65
1 1/2 to 1 1/2.....	75	62 1/2	69
2 to 3.....	76	63 1/2	70
Lap Weld, extra strong, plain ends			
2.....	72	57 1/2	64
2 1/2 to 4.....	74	59 1/2	66
4 1/2 to 6.....	73	58 1/2	68
7 to 8.....	67	50 1/2	67
9 to 12.....	62	45 1/2	60
Butt Weld, double extra strong, plain ends			
1/4.....	61	48 1/2	55
1/4 to 1 1/2.....	64	51 1/2	58
2 to 2 1/2.....	66	53 1/2	60
Lap Weld, double extra strong, plain ends			
2.....	62	49 1/2	56
2 1/2 to 4.....	64	51 1/2	58
4 1/2 to 6.....	63	50 1/2	57
7 to 8.....	57	40 1/2	50

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Boiler Tubes.—Discounts on less than carloads, f.o.b. Pittsburgh, freight to destination added, on lap welded steel tubes and standard charcoal iron tubes, effective from Dec. 1, 1915, are as follows:

Lap Welded Steel	Standard Charcoal Iron
1 1/4 in.....	1 1/4 in.....
1 1/2 and 2 in.....	1 1/2 and 2 in.....
2 1/4 in.....	2 1/4 in.....
2 1/2 and 2 3/4 in.....	2 1/2 and 2 3/4 in.....
3 and 3 1/4 in.....	3 and 3 1/4 in.....
3 1/2 to 4 1/2 in.....	3 1/2 to 4 1/2 in.....
5 and 6 in.....	5 and 6 in.....
7 to 13 in.....	7 to 13 in.....

Locomotive and steamship special charcoal grades bring higher prices.

1 1/4 in., over 18 ft., 10 per cent net extra.
2 in. and larger, over 22 ft., 10 per cent net extra.

Sheets.—Makers' prices for mill shipment on sheets, of U. S. standard gage, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms thirty days net, or 2 per cent cash discount in ten days from date of invoice:

Blue Annealed Sheets		Cents per lb.
Nos. 3 to 8.....		2.20
Nos. 9 to 10.....		2.25
Nos. 11 and 12.....		2.30
Nos. 13 and 14.....		2.35
Nos. 15 and 16.....		2.45

Box Annealed Sheets, Cold Rolled		Cents per lb.
Nos. 10 and 11.....		2.15 to 2.25
No. 12.....		2.15 to 2.25
Nos. 13 and 14.....		2.20 to 2.30
Nos. 15 and 16.....		2.25 to 2.35
Nos. 17 to 21.....		2.30 to 2.40
Nos. 22 and 24.....		2.35 to 2.45
Nos. 25 and 26.....		2.40 to 2.50
No. 27.....		2.45 to 2.55
No. 28.....		2.50 to 2.60
No. 29.....		2.55 to 2.65
No. 30.....		2.65 to 2.75

Galvanized Sheets of Black Sheet Gage		Cents per lb.
Nos. 10 and 11.....		3.75
No. 12.....		3.85
Nos. 13 and 14.....		3.85
Nos. 15 and 16.....		3.95
Nos. 17 to 21.....		4.10
Nos. 22 and 24.....		4.30
Nos. 25 and 26.....		4.45
No. 27.....		4.60
No. 28.....		4.75
No. 29.....		4.90

Pittsburgh

PITTSBURGH, PA., Dec. 28, 1915.

The embargo by the railroads on export shipments of iron and steel is still in force, with the result that domestic consumers are now getting better deliveries on contracts than they have had in some months. The situation is so strong that this has not affected prices, which are still very firm, but the week was quiet, likely due to the holiday season. An advance of 50c. per ton on Bessemer pig iron and 15c. per box on tin andterne plates are about the only changes in prices during the week. Consumers are well covered on their needs for the first quarter of 1916 and, in some cases, into second quarter. Reports vary as to the amount of steel that has been sold for third and fourth quarters, but it is not believed to be very large. Several local steel interests say they are being importuned to name prices for third and fourth quarters, but so far have not done so and have not sold. Consumers are still anxious to make reservations for material, but the mills are discouraging this, at least for third and fourth quarter business. Premiums are still being paid on some finished steel lines for prompt shipment. There is a feeling that prices are amply high, and any further advances should be discouraged.

Pig Iron.—Some Bessemer iron is reported to have been sold on the basis of \$20, Valley furnace, but it is stated this was given in exchange for ingot molds, so much per ton having been charged for conversion. Sellers are asking \$20 and even \$20.50, Valley furnace, for Bessemer iron, and the market is very strong. One interest has sold 1000 tons of Bessemer for January and the same for February for export at the reported price of \$20.50, Valley furnace. A local steel plant is reported to have bought about 4000 tons of Bessemer for delivery in the first three or four months of 1916, for which it paid \$19.50 or higher, Valley furnace. There is very little inquiry for basic or foundry iron, but the market is firm. We quote standard Bessemer iron, \$19.50 to \$20; basic, \$18; malleable Bessemer, \$17.50; gray forge, \$17.25, and No. 2 foundry, \$18.50, all at Valley furnace, the freight rate for delivery in the Pittsburgh and Cleveland districts being 95c. per ton.

Billets and Sheet Bars.—Inquiry for billets and sheet bars has quieted down, probably due to the holiday season, but demands of consumers for deliveries on their contracts are very insistent. Premiums of \$2 to \$3 per ton for Bessemer and open-hearth steel for prompt delivery would probably be paid. We note sales

of two cars of forging billets for prompt shipment, one at \$55 and one at \$56, f.o.b. Pittsburgh. We quote, for delivery at convenience of the mill, Bessemer billets and sheet bars at \$30 to \$31, and open-hearth billets and sheet bars at \$31 to \$32, maker's mill, Pittsburgh or Youngstown districts. We quote forging billets at \$55 to \$56, for sizes up to but not including 10 x 10 in. and for carbons up to 0.25, the regular extras being charged for larger sizes and higher carbons. Forging billets running above 0.25 and up to 0.60 carbon take \$1 per ton extra.

Ferroalloys.—Prices on English 80 per cent ferromanganese have been advanced to \$110, minimum, seaboard, with no guarantee as to deliveries. The minimum price of domestic 80 per cent ferromanganese is \$125 at furnace, and as high as \$130 has been quoted. We note sales of several carloads for prompt delivery at the lower price. Prices of Bessemer ferrosilicon for delivery in second quarter of 1916 are as follows: 9 per cent, \$27; 10 per cent, \$28; 11 per cent, \$29; 12 per cent, \$30; 13 per cent, \$31.50; 14 per cent, \$33.50; 15 per cent, \$35.50, and 16 per cent, \$38. Seven per cent silvery for same delivery is \$24.50; 8 per cent, \$25; 9 per cent, \$25.50; 10 per cent, \$26; 11 per cent, \$27, and 12 per cent, \$28. All these prices are f.o.b. at furnace, Jackson, Ohio, New Straitsville, Ohio, or Ashland, Ky., each of these points having a freight rate of \$2 per gross ton to Pittsburgh. We quote 50 per cent ferrosilicon for delivery through all of 1916 as follows: Up to 100 tons, \$85; over 100 tons and up to 600 tons, \$84, and over 600 tons, \$83, all per gross ton, delivered in the Pittsburgh district.

Plates.—There is an insistent demand for plates, which for shipment in three or four weeks are bringing 2c. and up to 2.25c. at maker's mill. For shipment at convenience of the mill, the ruling price is 1.80c. No orders for steel cars were placed the past week, but it is unofficially reported that the Pennsylvania Railroad will order a large number of cars shortly after the opening of the new year.

Structural Material.—The American Bridge Company has taken 3500 tons of steel bridge work for the International Railway Company, which is building a new electric line from Buffalo to Niagara Falls, also 1800 tons of steel for towers for the overhead electrical construction for the same road, and 520 tons for a new Chamber of Commerce building at Rochester, N. Y. The McClintic-Marshall Company has taken 800 tons for a four-story building for the Westinghouse Machine Company, East Pittsburgh, and 300 tons for an ore bridge for the Mead-Morrison Mfg. Company at Buffalo, N. Y. We quote beams and channels up to 15-in. at 1.80c. to 1.90c. at mill, Pittsburgh, according to delivery.

Steel Rails.—Fair sized orders for standard sections and light rails are being placed. The Carnegie Steel Company has about all the orders for both standard sections and light rails that it can turn out in the first six months of next year. We quote standard section rails of Bessemer stock at 1.25c., and of open-hearth, 1.34c., f.o.b., Pittsburgh. We now quote light rails as follows: 25 to 45-lb. sections, 1.55c.; 16 and 20 lb., 1.60c.; 12 and 14 lb., 1.65c.; 8 and 10 lb., 1.70c., in carloads, the usual advances being charged for less than carloads.

Sheets.—The demand for sheets has not been quite so active in the past week, probably due to the holiday season and also to the fact that consumers are well covered through first quarter of 1916. On blue annealed sheets several large makers are out of the market for delivery before second quarter. The American Sheet & Tin Plate Company is operating this week to 92 per cent of hot sheet mill capacity, and most other makers are running close to 100 per cent. Prices are very firm. An order for about 3000 tons of blue annealed sheets for steel cars will likely be placed this week. For delivery through first quarter we quote Nos. 9 and 10 blue annealed sheets at 2.25c.; No. 28 Bessemer black, 2.50c. to 2.60c., and No. 28 galvanized, 4.75c. We quote Nos. 22 and 24 gage black plate, tin mill sizes, H. R. and A., at 2.30c. to 2.40c.; Nos. 25, 26 and 27, 2.35c.; No. 28, 2.40c.; No. 29, 2.45c., and No. 30, 2.50c. These prices are for carload and larger lots, f.o.b. maker's mill.

Tin Plate.—All makers in the Pittsburgh district have advanced prices on bright coke plates to \$3.75 per base box, with the exception of the American Sheet & Tin Plate Company, which is likely to take the same action in a few days. It has been expected for some time that prices would be advanced because of the heavy demand and the higher prices the mills are paying for sheet bars. The same advance of 15c. per base box has also been made onterne plate. While nearly all large consumers of tin plate have covered, some for all of 1916, and others for only the first six months, it is said a good deal of tin plate is yet to be bought, and that consumers who have not covered will have to pay the higher price. The tin-plate mills are running to practically full capacity and have orders ahead for several months. We quote 14 x 20 coke plates at \$3.60 to \$3.75 per base box for delivery over all of next year, but the lower price will likely be withdrawn in a few days. We quote terne plate, 8-lb. coating, 14 x 20, at \$3.50 to \$3.65 per box, f.o.b. Pittsburgh.

Railroad Spikes.—The railroads have been buying very few spikes for some time and are not specifying freely on their contracts. Jobbers are placing orders quite actively and the spike makers are fairly well filled for the next two or three months. We quote standard spikes, larger than ½ in., at \$2.10; from ½ in. to ¾ in., \$2.20, and 5/16-in. and ¾-in. diameter, \$2.35, per 100 lb., f.o.b. at mill.

Skelp.—New buying this month was not as active as in previous months, but the mills report they are running about full and have a good deal of work ahead. We quote grooved steel skelp at 1.70c. to 1.75c.; sheared steel skelp, 1.80c. to 1.85c.; grooved iron skelp, 2.10c. to 2.15c., and sheared iron skelp, 2.20c. to 2.25c., all delivered to consumers' mills in the Pittsburgh district.

Wire Rods.—Local mills have practically no rods to sell in the open market for the next three or four months and are said not to be quoting on export inquiries. In view of the embargo on rods for export, domestic consumers will probably get better deliveries. We quote Bessemer, open-hearth and chain rods at \$40, maker's mill, but \$42 or higher has been offered for prompt rods without getting them.

Wire Products.—The recent advance in wire products is firmly held and premiums are still being paid on plain and barb wire for delivery within two or three weeks. Foreign buyers in this country are still offering jobbers fancy prices for their contracts with the mills, but which, it is said, are being refused. The claim is still made that there will be a shortage in supply of wire nails, but the embargo on export products may change this, as, for a time at least, present output will go very largely to domestic consumers. Prices quoted to the large trade and for shipment at convenience of the mill, are as follows: Wire nails, \$2.10; galvanized nails 1 in. and longer taking an advance over this price of \$2, and shorter than 1 in., \$2.50; plain annealed wire, \$1.95; galvanized barb wire and fence staples, \$2.95; painted barb wire, \$2.25; polished fence staples, \$2.25, all f.o.b., Pittsburgh, with freight added to point of delivery; terms sixty days net, less 2 per cent off for cash in ten days. Prices on woven wire fencing are 67½ per cent off list for carload lots, 66½ per cent for 1000-rod lots, and 65½ per cent for small lots, f.o.b., Pittsburgh.

Hoops and Bands.—Mills report specifications heavy, but new demand is not quite as active, as nearly all consumers are covered over first quarter, and large quantities of both hoops and bands have been sold for delivery in second quarter. We quote steel bands at 1.80c., with extras as per the steel bar card, and steel hoops at 2c., f.o.b. Pittsburgh.

Cold-Rolled Strip Steel.—Prices quoted on this material are largely nominal, as makers are sold up for three to four months. One leading maker is still quoting \$3.50 base on such deliveries as it can make, while several others are quoting \$3.75 base, and have refused much business at higher prices, being unable to make delivery. Premiums of from \$2 to \$5 per ton would readily be paid for prompt shipment. Export inquiry is quiet. We quote cold-rolled steel, 1½ in. and wider,

under 0.20 carbon, sheared or natural mill edge, per 100 lb., \$3.50 to \$3.75 delivered. Extras are as follows:

0.10 to 0.19 Carbon—1½ In. and Wider			
Coils		Lengths 24 In. and Over	
Hard	Soft	Hard	Soft
Base \$0.25	100 and heavier \$0.10	\$0.35	
\$0.05	0.20	0.20	0.45
0.20	0.45	0.35	0.60
0.35	0.75	0.60	1.00
0.45	0.85	0.85	1.25
0.55	0.95	1.05	1.45
1.35	1.35	2.45	2.45
1.75	1.75	2.85	2.85
2.45	2.45	3.70	3.70
2.80	2.80	4.30	4.30
3.15	3.15	4.65	4.65
3.50	3.50	5.00	5.00

Extras for soft apply for all intermediate tempers.

Shafting.—Prices on shafting are purely nominal, as none of the local makers has any to sell for delivery inside of four or five months. Two large makers are quoting 45 per cent off in carloads and 40 per cent in less than carloads, while another leading maker is still quoting 50 per cent off in carloads and larger lots and 45 per cent in small lots for delivery at its convenience, which would probably mean six months.

Iron and Steel Bars.—An inquiry is in the market for 2140 tons of reinforcing steel bars for delivery in the Cleveland district. The steel-bar mills are filled for three or four months and are back 8 to 10 weeks or longer in deliveries. The embargo on steel rounds for export shipment will likely help out domestic consumers very much, as large quantities of steel bars that have been going abroad will be diverted to domestic trade while the embargo lasts. The new demand for iron and steel bars is heavy, and the three or four bar-iron mills in this district are running practically full and with more orders than at any time for several years. The minimum price on steel bars for delivery in second and third quarter is 1.80c., but for reasonably prompt delivery as high as 2c. is quoted, and from stocks in warehouse 2.25c. and higher. We quote refined iron bars at 1.80c. to 1.85c., and railroad test bars 1.95c. to 2c., in carload lots, f.o.b. Pittsburgh.

Rivets.—Export shipments have stopped, and while the embargo lasts rivets that would have been exported will go to domestic users and deliveries will be much better. One local interest has two cars of rivets loaded for South America, but so far the railroads have refused to receive them. We quote button-head structural rivets, ½ in. and larger, at \$2.50, and cone-head boiler rivets at \$2.60 per 100 lb., in carload lots, f.o.b. Pittsburgh, smaller lots bringing about 10c. advance.

Nuts and Bolts.—Makers report continued heavy export and domestic demand, but the same shipping conditions apply as on rivets. Discounts for prompt acceptance and for shipment at convenience of the maker are as follows:

Carriage bolts, small, rolled thread, 70 & 12½ per cent off; small, cut thread, 70 & 5; large, 65. Machine bolts with h. p. nuts, small, rolled thread, 70 & 10 & 7½; small, cut thread, 70 & 12½; large, 65 & 10. Machine bolts with c. p. c. & t. nuts, small, 70; large, 60 & 10. Bolt ends, with h. p. nuts, 65 & 10; with c. p. nuts, 60 & 10. Lag screws (cone or gimlet point), 75. Rough stud bolts, 60. Forged set screws and tap bolts, 40. Hot pressed square nuts, tapped or blank, \$4.50 off list; hexagon, \$4.70 off. C. p. c. & t. square nuts, tapped or blank, \$4.00 off; hexagon, \$5.25 off. C. p. plain square nuts, tapped or blank, \$4.00 off; hexagon, \$4.20 off. Semi-finished hexagon nuts, 80 per cent off. Finished and case-hardened nuts, 75 & 10. Rivets, 7/16 in. diameter and smaller, 70 & 10. These prices are delivered in lots of 300 lb. or more where the actual freight rate does not exceed 20c. per 100 lb.

Merchant Steel.—One local mill reports that its shipments in December will be the heaviest in any one month in its history, and it is back in deliveries on some classes of steel eight weeks or longer. Prices are very strong and likely to be higher, premiums being paid for prompt shipment. For small lots for delivery at convenience of the mill we quote: Iron finished tire, ½ x 1½ in. and larger, 2.05c., base; under ½ x 1½ in., 2.20c.; planished tire, 2.25c.; channel tire, ¾ to ¾ and 1 in., 2.55c. to 2.65c.; 1 x ¾ in. and larger, 2.95c.; toe calk, 2.65c. to 2.75c., base; flat sleigh shoe, 2.40c.; concave and convex, 2.45c.; cutter shoe, tapered or bent, 2.95c. to 3.05c.; spring steel, 2.65c. to 2.75c.; machinery steel, smooth finish, 2.45c.

Carwheels.—Two local makers of forged steel carwheels state they have orders for all the wheels they can make inside of the next five or six months. The capacity of the Schoen works of the Carnegie Steel Company in the manufacture of forged steel wheels has recently been largely increased. We quote 33-in. freight carwheels in lots of 1000 or more at \$18; 33-in. tender wheels, \$21; 36-in. passenger or tender wheels, \$25. These prices are based on a 10-in. diameter hub, 50c. extra being charged for 11-in., all f.o.b. Pittsburgh.

Wrought Pipe.—The demand for oil country goods is very active and for wrought-iron and steel pipe is also heavy. Discounts are firmly held.

Boiler Tubes.—On seamless tubes the two local makers are sold up for six months, and this is causing some former consumers of such tubes to use boiler tubes, for which the new demand is very strong. Several local makers of boiler tubes say they have all the orders on their books they can fill in the next three months or longer. Discounts are very firm.

Old Material.—The list of the Pennsylvania Railroad Lines East, which came out last week, was the heaviest put out by that road for some time. The usual holiday dullness prevails in the scrap trade, consumers not being eager to buy and not willing to take in any old material until after the turn of the year, other than they can avoid. Dealers are not trying to make sales, however, believing that they will get more money for their scrap if buying starts again early in January. On some grades they are quoting 50c. to 75c. per ton higher. Dealers quote for delivery in the Pittsburgh and nearby districts that take the same rates of freight, as follows, per gross ton:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh delivery	\$17.50
Compressed side and end sheet scrap	16.00
No. 1 foundry cast	\$15.25 to 15.50
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	14.00 to 14.25
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	18.50 to 18.75
No. 1 railroad malleable stock	15.50
Railroad grate bars	10.75 to 11.00
Low phosphorus melting stock	21.50
Iron car axles	24.50 to 25.00
Steel car axles	26.00 to 26.50
Locomotive axles, steel	24.00 to 24.50
No. 1 busheling scrap	15.00
Machine shop turnings	10.00 to 10.25
Old carwheels	14.50
Cast-iron borings	10.75 to 11.00
*Sheet bar crop ends	18.00 to 18.50
Old iron rails	16.00 to 16.50
No. 1 railroad wrought scrap	17.50
Heavy steel axle turnings	13.50 to 14.00
Heavy breakable cast scrap	13.50 to 14.00

*Shipping point.

Coke.—Very little production of coke was lost on account of the Christmas holiday, and with no new demand, prices have eased off and best grades of prompt furnace coke could be had to-day at \$3 per net ton at oven or less. Most consumers of furnace coke are evidently covered on contracts, a few not covered buying from month to month. On contracts, furnace coke is held from \$2.40 to \$2.50 per net ton at oven for first half of 1916. We quote best grades of 72-hr. foundry coke for prompt shipment at about \$3.25, and on contracts \$3 to \$3.25 per net ton at oven. The Connellsville *Courier* reports the output of coke in the upper and lower Connellsville regions for the week ended Dec. 18 as 446,385 net tons, a decrease over the previous week of 4489 tons.

The Walsh & Weidner Boiler Company, Chattanooga, Tenn., is meeting with success in its recently installed structural steel department. It has built several bridges, including a large one at Nashville, and furnished fabricated steel for a number of buildings. The structural work bids fair soon to rival the older boiler and tank line. Two Chattanooga concerns are now producing fabricated steel, the other being the Converse Bridge & Steel Company.

There are no definite developments in the proposal which has been under consideration for the building of an open-hearth steel plant at Ashland, Ky., by the Ashland Iron & Mining Company.

Chicago

CHICAGO, ILL., Dec. 29, 1915.—(By Wire).

Interest in third quarter and last half pig-iron contracts is becoming general and inquiry of the past week includes a number of important tonnages. Sales also have been in amounts up to 8000 tons to individual consumers. With the advance in local iron to \$18.50 and Southern iron to \$15 and \$15.50, Birmingham, the early closing of considerable business is anticipated. Rail buying last week included 20,000 tons by the Southern Railway and 5000 tons by the Burlington. The new inquiry for rolled steel is immense and promises for the last half a continuance of first half conditions, but in this district little if any consideration has been specifically given to these tonnages. It is now fully recognized that nearly all mills will carry over into the third quarter large bookings on uncompleted contracts, and already specifications against first half contracts are being scheduled for July and August rolling. Warehouse orders are running heavy and prices have been advanced \$2 per ton. The market for old material is somewhat limited in the amount of consumer buying, but, with each sale bringing out higher quotations, the strength of the market is unmistakable.

Pig Iron.—With sales of about 8000 tons of Northern and Southern foundry iron to an eastern Wisconsin manufacturer, inquiry for a round tonnage from Milwaukee, likewise inquiry for 2000 tons from South Bend, Ind., indicating but a few of the activities of the pig-iron market, the advance in the price of local irons to the basis of \$18.50 at furnace and Southern iron to the general level of \$15, Birmingham, seems well supported. The willingness of most of the furnaces to take on business for the third quarter is not more aggressive than the willingness of many founders to consider tonnage for that delivery. There is, in fact, a general consideration of iron for shipment in that period. The several sales of Southern iron last week for first half delivery were made on a basis of \$14.50, Birmingham, for No. 2 but at the beginning of this week the prevailing price appears to be at least 50c. per ton higher while a sale of 500 tons of 2.50 to 3 per cent silicon has been made at \$15.50. An active interest in silvery irons is reported. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5	\$19.25 to \$19.75
Lake Superior charcoal, No. 1	19.75 to 20.75
Lake Superior charcoal, No. 6 and Scotch	20.25 to 21.25
Northern coke foundry, No. 1	19.00
Northern coke foundry, No. 2	18.50
Northern coke foundry, No. 3	18.00
Southern coke, No. 1 f'dry and 1 soft	19.00 to 19.50
Southern coke, No. 2 f'dry and 2 soft	18.50 to 19.00
Malleable Bessemer	18.50
Basic	18.00
Low phosphorus	32.00 to 36.00
Silvery, 8 per cent	26.50
Silvery, 10 per cent	27.50

(By Mail)

Rails and Track Supplies.—Of the Southern Railway's purchase of nearly 20,000 tons of rails, only 3000 tons was placed at Chicago, the remainder being divided, 12,000 to the Pennsylvania Steel Company and 5000 tons to Cambria. The Burlington augmented its previous purchases of the year with an additional 5000 tons which will be rolled at Buffalo. Although rail orders in 1915 have exceeded the tonnage in sight at the beginning of the year, it is unlikely that the rails rolled at Chicago were any in excess of 50 per cent of mill capacity. We quote standard railroad spikes at 2.10c., base; track bolts with square nuts, 2.50c., base, all in carload lots, Chicago; tie plates, \$36, f.o.b. mill, net ton; standard section, Bessemer rails, Chicago, 1.25c., base, open hearth, 1.34c.; light rails, 25 to 45 lb., 1.43c.; 16 to 20 lb., 1.48c.; 12 lb., 1.53c.; 8 lb., 1.58c.; angle bars, 1.50c., Chicago.

Structural Material.—Car inquiry is again assuming large proportions and it is known that many cars for which no inquiry has appeared would be purchased were the steel available for their building. The Penn-

sylvania is in the market for 9000, the Union Pacific for 2000 and the Denver & Rio Grande for 1000. In connection with car building, the sale of the plant of the Haskell & Barker Car Mfg. Company to interests which, it is commonly reported, will add a steel works and finishing mills to the present plant, is of foremost interest. Structural lettings of the week included a number of contracts of less than 500 tons, largely for work on the Pacific coast. The St. Louis Dispatch Building, calling for 1300 tons, and awarded to Christopher & Simpson and a hospital at San Francisco for which Dyer Brothers will furnish 1400 tons, were the large transactions. Delivery conditions are increasingly disappointing to the users of steel. Specifications against first-half contracts, now being received, are scheduled for rollings in July and August and, except for the limited tonnage of premium steel, nothing better can be had. To cover specific work some new orders for structural tonnage are being accepted by the mills for delivery in the third quarter. Prices are unchanged and we quote for Chicago delivery from mill, 1.989c.

The movement of material out of store has at last struck a gait commensurate with mill conditions. Prices have been advanced \$2 per ton and we quote for Chicago delivery from store 2.40c.

Plates.—The amount of business being done in plates in lots up to 500 tons, by the mills able to make reasonably prompt deliveries, at prices equivalent to prices out of stock, is surprising. It is significant of the fact that many plate fabricators have been caught unawares and are in need of larger tonnages than the stores care to handle. We quote for Chicago delivery from mill the nominal price of 1.989c., noting also prices of 2.20c. to 2.30c. at which considerable business is being placed.

We quote for Chicago delivery of plates out of store an advance of \$2 a ton to 2.40c.

Sheets.—Of itself, the sheet trade has little of market interest to make it conspicuous, but influenced by the conditions affecting finished products in general, prices are tending higher, and an advance of \$2 per ton is being quoted, although 2.689c. can still be done. We quote for Chicago delivery from mill, No. 10 blue annealed, 2.439c.; No. 28 black, 2.689c.; No. 28 galvanized, 4.689c. to 5c.

We quote for Chicago delivery from jobbers' stock as follows, minimum prices applying on bundles of 25 or more: No. 10 blue annealed, 2.60c.; No. 28 black, 2.90c.; No. 20 and heavier galvanized, 4.80c.; No. 22 and lighter, 5c.

Bars.—Inquiry for bars for export is again appearing in huge tonnages. It is not yet apparent in what manner the mills will be enabled to consider this business. Bar-iron tonnage is not as heavy as might be expected in view of the scarcity of steel bars but the price is exceedingly firm at 1.75c., and on some business 1.80c. has been done. We quote mill shipments, Chicago, as follows: Bar iron, 1.75c.; soft steel bars, 1.989c.; hard steel bars, 1.80c. to 2c.; shafting, in carloads, 50 per cent off; less than carloads, 45 per cent off.

We quote store prices for Chicago delivery: Soft steel bars, 2.30c.; bar iron, 2.30c.; reinforcing bars, 2.30c., base, with 5c. extra for twisting in sizes $\frac{1}{2}$ in. and over and usual card extras for smaller sizes; shafting 35 per cent off.

Rivets and Bolts.—The trade in bolts and nuts continues brisk and sound and specifications are being sent in freely though little new business is being taken at the latest advance in prices. The buying of rivets is without feature. The following discounts represent the recent advance, and we quote as follows: Carriage bolts up to $\frac{3}{8}$ x 6 in., rolled thread, 70-12 $\frac{1}{2}$; cut thread, 70-5; larger sizes, 65; machine bolts up to $\frac{3}{8}$ x 4 in., rolled thread, with hot pressed square nuts, 70-10-7 $\frac{1}{2}$; cut thread, 70-12 $\frac{1}{2}$; larger sizes, 65-10; gimlet point coach screws, 75; hot pressed nuts, square, \$4.70 off per 100 lb.; hexagon, \$4.50 off. Structural rivets, $\frac{3}{4}$ to 1 $\frac{1}{2}$ in., 2.60c. to 2.65c., base, Chicago, in carload lots, boiler rivets, 10c., additional.

We quote revised prices, out of store: Structural rivets, 2.60c.; boiler rivets, 2.70c.; machine bolts up to $\frac{3}{8}$ x 4 in., 70-12 $\frac{1}{2}$; larger sizes, 65-10; carriage bolts up to $\frac{3}{8}$ x 6 in., 70-5; larger sizes, 65 off; hot pressed nuts square, \$4.50, and hexagon, \$4.70 off per 100 lb.; lag screws, 75.

Cast-Iron Pipe.—The United States Cast Iron Pipe & Foundry Company took the contract for 400 tons at Muscatine, Iowa. No other business of moment has

been placed. A small tonnage is up for figures at Battle Creek, Mich. We quote as follows per net ton, Chicago: Water pipe, 4 in., \$30; 6 in. and larger, \$28, with \$1 extra for class A water pipe and gas pipe.

Wire Products.—Wire manufacturers are doing what they can to discourage additional contracting for wire but the rapid advances in prices have not been altogether effective in checking buying. Our prices have been revised in keeping with the recent advance of \$2 per ton and we quote to jobbers as follows: Plain wire, No. 9 and coarser, base, \$2.139; wire nails, \$2.289; painted barb wire, \$2.439; galvanized barb wire, \$3.139; polished staples, \$2.439; galvanized staples, \$3.139, all Chicago.

Old Material.—Activity in the scrap market has been limited very largely to adjustments of their orders among the dealers. There has been little general buying, except for the steady absorption of steel scrap. Price changes have been few within a fortnight, but there are many indications that a sharp movement in values is in the making. Dealers are now offering premiums for delivery of material immediately following the opening of the new year. Railroad scrap offerings include 1000 tons of relayers from the Vandalia, 2500 tons from the St. Paul and about 2000 tons from the Burlington. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton	
Old iron rails	\$16.00 to \$16.50
Relaying rails	19.50 to 20.50
Old carwheels	14.75
Old steel rails, rerolling	17.00 to 17.50
Old steel rails, less than 3 ft.	16.50 to 16.75
Heavy melting steel scrap	16.00 to 16.50
Frogs, switches and guards, cut apart	16.00 to 16.50
Shoveling steel	15.50 to 16.00
Steel axle turnings	11.75 to 12.25

Per Net Ton	
Iron angles and splice bars	\$17.00 to \$17.25
Iron arch bars and transoms	18.00 to 18.50
Steel angle bars	14.50 to 15.00
Iron car axles	19.50 to 20.00
Steel car axles	21.50 to 22.00
No. 1 railroad wrought	16.00 to 16.25
No. 2 railroad wrought	14.25 to 14.75
Cut forge	14.25 to 14.75
No. 1 busheling	13.25 to 13.50
No. 2 busheling	9.25 to 9.50
Pipes and flues	12.00 to 12.50
Steel knuckles and couplers	15.00 to 15.50
Steel springs	16.00 to 16.50
No. 1 boilers, cut to sheets and rings	11.00 to 11.50
Boiler punchings	13.75 to 14.25
Locomotive tires, smooth	15.75 to 16.25
Machine shop turnings	8.75 to 9.00
Cast borings	7.75 to 8.00
No. 1 cast scrap	13.75 to 14.25
Stove plate and light cast scrap	11.00 to 11.50
Grate bars	11.00 to 11.50
Brake shoes	10.25 to 10.75
Railroad malleable	13.75 to 14.00
Agricultural malleable	11.50 to 12.00

Philadelphia

PHILADELPHIA, PA., Dec. 28, 1915.

Unlike other years, activity lasted until Christmas Eve, and Monday morning's mail was heavy. In no way does the market show any change except that steel, both finished and semi-finished, is more difficult to procure. No relief can be looked for until open-hearth capacity is increased. The situation is illustrated by the conditions of one large company, which ordinarily sells a wide line of products, but which now has only standard railroad spikes to offer. It is sold up for the first half of 1916 and not considering second half contracts. Another large mill is filled up save for heavy bridge and railroad switch and signal work, but if it had more fabricating to do it would have to buy the steel, inasmuch as its production is absorbed by its finished products. Foreign inquiry for second quarter and second half deliveries of rounds, squares, forgings and billets is growing heavier, most of it being for material needed in the manufacture of shells. Pig iron is firm, except for the offering of resale Virginia iron, at a small concession. Some good-sized orders for foundry iron have been placed. Steel-making iron is quiet. English ferromanganese has been advanced to \$110, seaboard.

Pig Iron.—Activity was good up to the eve of the holiday, and was resumed the first working day after

Christmas. Furthermore, the outlook continues good. Quotations still show considerable variance. It is noticeable that those sellers who ask the higher prices report a good aggregate of orders, but that most of their transactions involve small or moderate-sized tonnages. On the other hand, those who are not so stiff in their quotations have booked larger orders. Despite this irregularity, the market is by no means weak. Inquiries are plentiful, largely for the second quarter, into which some producers are inclined to go rather lightly because of their strong faith in the future. A few consumers have not covered for the first quarter. They were supplied to the end of the year with cheap iron, now they must pay several dollars a ton more. The Norfolk & Western Railroad, which recently inquired for 10,000 tons of miscellaneous grades for the last half, has closed for 6000 tons. A New England foundry which inquired for 7000 tons of No. 2 plain closed for 4000 tons. Other lots of foundry grades taken in the week were 1200 and 1500 tons. Some resale of Virginia iron has made its appearance in the market. It is understood that a New York syndicate, which bought the iron some time ago, has taken its profit, and several thousand tons are now in various hands. The present holders have been willing to grant a concession of 25c. per ton under the prices now asked by Virginia makers. The latter continue to quote No. 2 X at \$17.25, furnace, for first quarter and first half; \$17.50 for the second quarter alone, and \$18 for the third quarter or last half. Some special second quarter Virginia No. 2 X is reported to have been taken at \$19, furnace. One Virginia maker has booked 40,000 tons for the last half, and has over 200,000 tons in unfilled orders. A maker of eastern Pennsylvania No. 2 X continues to quote first quarter at \$20, furnace, or about \$20.80, Philadelphia. Another brand is quoted at \$20.75, delivered. A round lot of eastern Pennsylvania gray forge has been taken at \$18.50, delivered. Basic has been quiet. One or two small lots are reported to have been purchased at a high price because of special features. The market is close to \$19, delivered. Low phosphorus is unchanged at \$32, delivered. Quotations for standard brands, delivered in buyers' yards, prompt shipment, range about as follows:

Eastern Pa., No. 2 X foundry.....	\$19.50 to \$20.00
Eastern Pa., No. 2 plain.....	19.25 to 19.75
Virginia, No. 2 X foundry.....	19.50 to 20.00
Virginia No. 2 plain.....	19.00 to 19.50
Gray forge.....	18.00 to 18.50
Basic.....	18.50 to 19.00
Standard low phosphorus.....	32.00

Iron Ore.—Arrivals of foreign ore at this port in the week ended Dec. 25 consisted of 13,150 tons from Cuba and 12,980 tons from Chile. The heavy activity in New York and New Jersey ores has subsided, the movement having been the largest on record, and sufficient to keep the mines in those States active for the next year.

Ferroalloys.—By direction of the English producers agents handling imported 80 per cent ferromanganese have advanced their quotations to \$110 per ton, seaboard. Spot ferromanganese is quoted at \$120 to \$125, seaboard. The market has been fairly active, especially in small lots. At the new price 500 tons of English ferromanganese was taken yesterday. The only arrival reported here last week was one of 500 tons.

Bars.—Dealers in concrete reinforcing bars are fairly well stocked, and in such bars there is not the acute shortage that exists for ordinary steel bars. Reinforcing bars became quiet with the approach of the holiday and probably will remain so until January. The nominal quotation for steel bars is 1.959c., Philadelphia, but premiums must be paid to secure anything like prompt shipment. Iron bars are strong and active at 2.059c., Philadelphia, for carloads, and 2.191c. for less than carloads.

Plates.—Leading makers declare themselves to be swamped with specifications. Their quotations are unchanged at 2.409c., Philadelphia, to old and steady customers, and 2.905c. to those who are termed outsiders. No business is being taken for the second quarter, at least by some of the eastern mills.

Structural Material.—A period of readjustment now exists, inasmuch as a new quarter is about to be entered. Many of the consumers of shapes have been specifying on contracts, good to the end of the year, which were made at prices ranging from 1.359c. upward. But their specifications for the early part of next year will call for material for which much higher prices must be paid, and they are inclined to hold back in specifying as long as they can. Many of them will have to pay at least 1.80c., Pittsburgh, or 1.959c., Philadelphia. Current business with eastern Pennsylvania mills continues to command 2.159c., Philadelphia, to best customers, and 2.25c., Pittsburgh, or Eastern mill, depending on freight rates to the consumer's point. The state of the market is illustrated by the request of a consumer, with a 500-ton inquiry, to be protected for two weeks at 2.25c. The bulk of the first quarter business taken some time ago by the big mills further west was at about 1.40c., Pittsburgh. New propositions of notable size are lacking at the present time, though some are in view in early 1916. Current business is practically made up of small, miscellaneous lots. One Eastern mill which does large bridge work has capacity to take on more fabricating, though it would have to buy the steel. In most departments it is filled.

Rails.—No new rail business is reported, but one or two orders from Southern roads are pending.

Billets.—With the two leading eastern Pennsylvania makers of billets for the trade their capacity is fully sold for months to come. The pressing demand for their finished products has restricted their sale of billets. Meanwhile the foreign demand for second quarter and second half delivery is growing stronger. Second quarter forging billets command \$50, delivered, and open-hearth rerolling billets about \$40.

Sheets.—Makers are deluged with orders and specifications. The quotation for No. 10 blue annealed is unchanged at 2.659c., Philadelphia.

Coke.—Contracting is quiet, but there is considerable activity in spot coke. Some of the furnaces are keeping more en route than they usually do as a precaution against running short, preferring to pay demurrage rather than face a shut-down. Prompt furnace is quoted at \$3.25 to \$3.50 per net ton at oven and contract through the first half at \$2.35 to \$2.50. Prompt foundry is quoted at \$3.50 to \$4, and contract at \$3 to \$3.50. Freight rates from the principal producing districts follow: Connellsville, \$2.05; Latrobe, \$1.85, and Mountain, \$1.65.

Old Material.—With the holiday the market has been somewhat slower, but not as quiet as usual at this season. A light week is expected, after which, when inventories are out of the way, a jump in activity is looked for. Railroad wrought continues in heavy demand, with the strength of wrought pipe another feature. Quotations for delivery in buyers' yards in this district, covering eastern Pennsylvania and taking freight rates from 35c. to \$1.35 per gross ton, are as follows:

No. 1 heavy melting steel.....	\$16.00 to \$16.50
Old steel rails, rerolling.....	18.00 to 19.00
Low phos. heavy melting steel scrap..	21.50 to 22.50
Old steel axles.....	25.00 to 26.00
Old iron axles.....	27.00 to 28.00
Old iron rails.....	19.50 to 20.00
Old carwheels.....	16.00 to 16.50
No. 1 railroad wrought.....	21.00 to 21.50
Wrought-iron pipe.....	16.00 to 16.50
No. 1 forge fire.....	13.00 to 13.50
Bundled sheets.....	13.00 to 13.50
No. 2 busheling.....	10.50 to 11.00
Machine shop turnings.....	11.50 to 12.00
Cast borings.....	11.50 to 12.00
No. 1 cast.....	16.75 to 17.25
Grate bars, railroad.....	12.50 to 13.00
Stove plate.....	13.00 to 13.50
Railroad malleable.....	15.00 to 15.50

The Allis-Chalmers Mfg. Company, Milwaukee, Wis., Dec. 24, distributed checks to its 1200 office employees to compensate for the 10-per cent reduction in salaries made a year ago, because of bad business conditions. On July 1 a 5 per cent increase in wages was made and another 5 per cent Sept. 1. President Otto H. Falk announces that the improvement in business has been such that it has been decided to reimburse the employees for the reduction suffered in their salaries.

Cleveland

CLEVELAND, OHIO, Dec. 28, 1915.

Iron Ore.—Prices on old range Bessemer and non-Bessemer ores have been reduced 5c. per ton. When prices were established a few weeks ago by sales at an advance of 75c. per ton, one selling agent took orders for old range ores at an advance of 70c. Other sellers have now decided to meet this price and to adjust contracts already made on the same basis. Following the heavy buying movement, the market is not active, although it is expected to improve after the holiday season. Most steel plants have bought heavily and are believed to have under contract about all the ore they will need, but a number of the merchant furnaces have not yet covered for their complete requirements. Sales of higher grade ores have been particularly heavy. We quote prices as follows, delivered lower Lake ports: Old range Bessemer, \$4.45; Mesaba Bessemer, \$4.20; old range non-Bessemer, \$3.70; Mesaba non-Bessemer, \$3.55.

Pig Iron.—Cleveland prices have again been advanced 50c. per ton to \$19 for No. 2 foundry iron for local delivery. For out of town shipment \$18.50 is still being quoted, and that is the minimum price named by Valley furnaces and in Toledo. Higher prices are being quoted at the latter point, where \$18.50 is now the minimum. Some producers are asking \$19, and small lot sales have been made at that price. There is no activity in steel-making iron and other grades are rather quiet. Some last half inquiries are coming out, but furnaces are refusing to quote for shipment beyond the first half. Some consumers, being unable to buy for more extended delivery, have purchased iron far in excess of their first half requirement and will have nearly enough to last them through the year. We note the sale of 500 tons to a Cleveland foundry at \$19. Small lot sales of Southern iron are being made at \$14.50, Birmingham, for No. 2 for the first half, and one seller is now making a quotation of \$16 for the second half, for which there is considerable inquiry, although no sales are reported for that delivery. We quote, delivered Cleveland, as follows:

Bessemer	\$20.00
Basic	19.30
Northern No. 2 foundry	19.30
Southern No. 2 foundry	18.50
Gray forge	18.30
Jackson Co. silvery 8 per cent silicon	26.62
Standard low phos., Valley furnace	31.00

Coke.—There is a fair demand for foundry coke for prompt shipment and prices are higher. Standard Connellsville foundry coke is quoted at \$3.75 to \$4.15 per net ton at oven for prompt shipment and \$3.25 to \$3.50 for contracts. We note the sale of some Wise County coke in this market at \$3.50 for prompt shipment.

Finished Iron and Steel.—The holiday season has caused only a slight falling off in the demand, but few mills have anything to sell except for extended future delivery. Considerable inquiry is coming from railroads for structural material for bridge work. A Youngstown mill has taken 4000 tons of Bessemer sheet bars at \$33, of which 1000 tons is for prompt shipment and the remainder for delivery in the first quarter. The Limestone Transportation Company has placed an order for a boat for 1917 delivery with the American Shipbuilding Company and the latter has contracted for 4500 tons of plates and structural material for the vessel. A number of other inquiries for boats for 1917 delivery are pending, but it is believed that the present high prices of steel will curtail the number of orders for Lake boats. About a year ago ship plates were purchased as low as 1.05c., and the present price of 1.80c., or an advance of \$15 per ton, means an increase of \$60,000 or more in the cost of the steel for a large boat. In structural lines the King Bridge Company has taken 4000 tons for bridge work for the Cleveland & Youngstown Railroad and the Riverside Bridge Company 1900 tons for a power plant for the American Gas & Electric Company at Beach Bottom on the Ohio River near Wheeling. Plates are well established at 2.50c., base, Pittsburgh, in this market for early ship-

ment. The demand for ¼-in. plates is heavy and the usual differentials are not being charged for lighter gages. Eastern mills are selling structural material at 2c. to 2.25c., at mill, for early shipment. There is considerable inquiry for sheet contracts, but many of the mills cannot take on additional tonnage for the first quarter. We quote black sheets at 2.60c. to 2.75c. at mill for No. 28; blue annealed, 2.30c. to 2.50c. for No. 10 and galvanized sheets, 4.75c. to 5c. for No. 28. Iron bars are quoted at 1.90c., Pittsburgh, and hard steel bars at 1.75c. Jobbers are closing out their stocks of shafting and spikes at about present mill prices. Warehouse business continues heavy. We quote steel bars, plates and structural material out of stock at 2.50c.; 2-in. and larger rounds, 3c., and 2-in. and larger squares, 2.65c.

Bolts, Nuts and Rivets.—Many consumers, particularly automobile builders, are unable to get deliveries on contracts as fast as desired and are in the market for bolts and nuts for prompt shipment. Specifications continue heavy, although not much business in contracts is being placed at present. Rivets are in good demand, with prices unchanged at 2.50c., Pittsburgh, for structural and 2.60c. for boiler rivets, in carload lots. Bolt and nut discounts are as follows:

Common carriage bolts ¾ by 6 in., smaller or shorter, rolled thread, 70 and 12½, cut thread, 70 and 5, larger or longer, 65; machine bolts with h. p. nuts, ¾ x 4 in., smaller or shorter, rolled thread, 70, 10 and 7½, cut thread, 70 and 12½, larger and longer, 65 and 10; lag bolts, gimlet or cone point, 75, square h. p. nuts, blank or tapped, \$4.50 off list; hexagon h. p. nuts, blank or tapped, \$4.70 off; c. p. c. and t. square nuts, blank or tapped, \$4 off; hexagon nuts, all sizes, \$5.25 off; cold pressed semi-finished hexagon nuts, all sizes, 50 off.

Old Material.—The scrap market has been rather dull during the holiday season, but very firm and higher prices are being asked for several grades. Some sales have been made at the advance. Heavy melting steel has sold at \$18 and possibly higher in the local market, carwheels at \$14.50 and railroad malleable at \$17.50. Busheling for delivery after Jan. 20 has brought as high as \$15.25 for No. 1. While most mills were out of the market during the week, dealers look for considerable activity soon after the new year opens. We quote, f.o.b. Cleveland, as follows:

Per Gross Ton

Old steel rails	\$15.75 to \$16.00
Old iron rails	19.00
Steel car axles	23.00 to 24.00
Heavy melting steel	16.50 to 17.00
Old carwheels	14.00 to 14.50
Relaying rails, 50 lb. and over	22.50
Agricultural malleable	14.00 to 14.25
Railroad malleable	16.75 to 17.25
Steel axle turnings	13.50 to 14.00
Light bundled sheet scrap	12.75 to 13.25

Per Net Ton

Iron car axles	\$23.00 to \$24.00
Cast borings	8.50 to 8.75
Iron and steel turnings and drillings	7.75 to 8.00
No. 1 busheling	14.25 to 14.75
No. 1 railroad wrought	17.00 to 17.50
No. 1 cast	13.00 to 13.50
Railroad grate bars	10.50 to 11.00
Stove plate	9.50 to 10.00

The M. E. Lazarus Company, scrap iron dealer, Cleveland, Ohio, has moved into larger quarters at 976-78 Rockefeller Building.

Cincinnati

CINCINNATI, OHIO, Dec. 29, 1915.—(By Wire.)

Pig Iron.—A central Ohio manufacturer bought last week 3000 tons of iron for last half shipment of which 1000 tons went to a Virginia concern for shipment from a Kentucky furnace; 1500 tons to the Ironton district and 500 tons to a Lake furnace. It is understood that practically all of this iron was purchased at the prevailing first half prices last week. A Louisville melter also took 1000 tons of Southern foundry for the same delivery. A sale of approximately 2000 tons of speculative Southern iron was made to a nearby melter and this practically cleans up the bargain lots in the South. Southern No. 2 foundry is held by the majority of furnaces at \$15, Birmingham basis, for first half shipment, and for last half all the way from \$15 to \$16 is quoted, although there is still some prompt

shipment iron obtainable at \$14.50. Northern foundry iron has been marked up to \$18, Ironton, for first half shipment but some business has been taken at the same price for the last half. The Virginia irons that have lately sold quite freely in this territory have advanced, and competition from this source is now more evenly balanced with Hanging Rock quotations. The Ohio silvery irons are firm and unchanged at \$25 at furnace on an 8 per cent analysis. Both malleable and basic are scarce, being unobtainable for prompt shipment except on old contracts. Based on freight rates of \$2.90 from Birmingham and \$1.26 from Ironton, we quote, f.o.b., Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft.	\$17.90 to \$18.40
Southern coke, No. 2 f'dry and 2 soft.	17.40 to 17.90
Southern coke, No. 3 foundry.	16.90 to 17.40
Southern No. 4 foundry.	16.40 to 16.90
Southern gray forge	15.90 to 16.40
Ohio silvery, 8 per cent silicon.	26.26 to 26.76
Southern Ohio coke, No. 1.	20.26 to 20.76
Southern Ohio coke, No. 2.	19.26 to 19.76
Southern Ohio coke, No. 3.	18.76 to 19.26
Southern Ohio malleable Bessemer.	18.76 to 19.26
Basic, Northern	18.76 to 19.26
Lake Superior charcoal	20.70 to 21.70
Standard Southern carwheel	24.40 to 24.90

(By Mail)

Coke.—Spot furnace coke is higher, now being quoted from \$3.40 to \$3.60 per net ton at oven in all districts. Contract business can be taken for first half around \$2.40 to \$2.50 and for the whole of next year could probably be made at a lower figure. Foundry coke is quoted from \$3.50 to \$3.75 at oven for prompt shipment, but some standard brands are available on contract in all three fields under these prices. Very little business is being transacted in either 38 or 72-hr. coke, and nothing of consequence is under negotiation.

Finished Material.—Local warehouses report quite a brisk business, which is something out of the ordinary for the holiday season. Store prices have advanced and are as follows: Steel bars, 2.45c.; structural shapes, 2.55c.; No. 10 blue annealed sheets, 2.65c., and No. 28 galvanized sheets, 5c. Wire nails are unchanged at \$2.15 base per keg. Nearby rolling mills quote No. 28 black sheets at 2.65c., Cincinnati and Newport, Ky., and No. 28 galvanized at 5.15c. Railroad track material is dull.

Old Material.—Not many transactions of note have been made at either the buying or selling end of the business, although prices continue very firm. It will probably be well along in January before scrap begins to move freely. There is a demand for steel turnings from shrapnel forgings that have a high carbon average, but stable quotations on this class of material are wanting. The minimum figures given below represent what dealers are willing to pay for delivery in their yards, southern Ohio and Cincinnati, and the maximum quotations are dealers' prices f.o.b. at yards:

Per Gross Ton	
Bundled sheet scrap	\$11.00 to \$11.50
Old iron rails	15.75 to 16.25
Relaying rails, 50 lb. and up.	21.25 to 21.75
Rerolling steel rails	15.00 to 15.50
Heavy melting steel scrap	14.50 to 15.00
Steel rails for melting	14.25 to 15.25
Per Net Ton	
No. 1 railroad wrought	\$13.75 to \$14.25
Cast borings	7.75 to 8.25
Steel turnings	7.50 to 8.00
Railroad cast scrap	12.00 to 12.25
No. 1 machinery cast scrap	13.75 to 14.25
Burnt scrap	9.00 to 9.50
Iron axles	19.50 to 20.00
Locomotive tires (smooth inside)	13.50 to 14.00
Pipes and flues	10.50 to 11.00
Malleable and steel scrap	11.00 to 11.50
Railroad tank and sheet scrap	9.00 to 9.50

Birmingham

BIRMINGHAM, ALA., Dec. 27, 1915.

Pig Iron.—The close of last week saw prices firm at \$15 for the first half and \$16 for the second half of 1916. On Dec. 24 the Tennessee Company announced these prices; the Sloss-Sheffield and Republic companies were already on that basis, although the Republic had not yet opened books for the second half, and the Woodward had advanced to \$15.50. Sloss-Sheffield led off in business for the second half by booking 6000 tons at \$16 in a few days just prior to Christmas. The Tennessee Company also participated

in the second half sales on the same basis. So far the demand that sales were made on Christmas eve around closing hours. The general disposition of the iron makers is not to force the market. The average cost of production in Alabama at this time is probably \$8.50 to \$9 and net profit is now around \$6 to \$7 per ton. Furnacemen are inclined to be content with this handsome return, but the pressure is strong and it seems impossible to prevent a further advance. A scarcity of some grades is also developing. One interest has no No. 2 foundry or soft on hand. Almost all have sold all they especially desire to sell at this time for the first half. The Tennessee Company has received more manganese ore from Brazil and will continue making ferromanganese for its own use. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	\$15.50 to \$16.00
No. 2 foundry and soft	15.00 to 15.50
No. 3 foundry	14.50 to 15.00
No. 4 foundry	14.25 to 14.75
Gray forge	14.00 to 14.50
Basic	15.00 to 15.50
Charcoal	23.00 to 23.50

Cast-Iron Pipe.—The foundries which have been active for some time report maintenance of their operations, but it is observed that the rehabilitated Dimmick plant of the United States Cast Iron Pipe & Foundry Company and the Lynchburg Company's plant in Aniston are still idle. Several soil pipe factories have resumed. General conditions are improving and prices are hardening at the advance. We quote, per net ton, f.o.b. pipe shop yards, as follows: 4-in., \$24; 6-in. and upward, \$22, with \$1 added for gas pipe.

Coal and Coke.—The coal market has recovered considerably, but there are still many mines which are not working on full time. Coke is active and strong. The Gulf States Steel Company is negotiating for the building of a by-product plant and the Yolande Coal & Coke Company, it is reported on good authority, will also build one. The plans of the Sloss-Sheffield in that direction appear less definite. We quote, per net ton, f.o.b. oven, as follows: Beehive furnace, \$2.75 to \$3; foundry, \$3.25 to \$3.50, with \$3.75 for Yolande.

Old Material.—Dealers find no difficulty in maintaining a firm attitude on prices, disposing of stocks as fast as accumulated. Very little is now carried in the yards. Steel mills are taking all that can be found. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old iron axles	\$14.50 to \$15.00
Old steel axles	14.00 to 14.50
Old iron rails	13.50 to 14.00
No. 1 railroad wrought	10.50 to 11.00
No. 2 railroad wrought	9.50 to 10.00
No. 1 country wrought	9.00 to 9.50
No. 1 machinery cast	10.00 to 10.50
No. 1 steel scrap	10.00 to 10.50
Tram carwheels	10.00 to 10.50
Stove plate	8.00 to 8.50

St. Louis

ST. LOUIS, MO., Dec. 27, 1915.

Pig Iron.—Specifications on existing contracts for December were in early and have practically all been covered in the shipments, while January specifications are beginning to come in. Furnaces continue to hold representatives down to submission of transactions even in small lots and show no disposition to contract for last half. Sales include 600 tons of No. 2 Southern and 400 tons of No. 3 Southern, several lots of 200 tons of No. 2 Southern, one of 200 tons of charcoal iron and one of 500 tons of No. 2 Northern foundry. An inquiry is out for 100 tons of ferromanganese.

Coke.—The small transactions of the week have commanded prices above the general market because of their size and the conditions. Local by-product coke continues to dominate the general market at \$5.80.

Finished Iron and Steel.—Buyers of finished products continue to exert pressure for contracts for the last half. There is some hope that the export embargo conditions may result favorably for domestic consumers. Stock is moving very freely out of warehouse at these prices: Soft steel bars, 2.35c.; iron bars, 2.30c.; structural material, 2.45c.; tank plate, 2.45c.; No. 10 blue

annealed sheets, 2.75c.; No. 28 black sheets, cold rolled, one pass, 3c.; No. 28 galvanized sheets, black sheet gage, 5c.

Old Material.—The scrap market continues strong, with indications of higher prices after the first of the year. Dealers report no difficulty in placing material. The only list out this week is one of 2000 tons from the Chicago, Burlington & Quincy. We quote dealers' prices, f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton	
Old iron rails	\$15.50 to \$16.00
Old steel rails, rerolling	17.00 to 17.50
Old steel rails, less than 3 ft.	16.50 to 17.00
Relaying rails, standard section, subject to inspection	21.00 to 23.00
Old carwheels	13.50 to 14.00
No. 1 railroad heavy melting steel scrap	15.50 to 16.00
Heavy shoveling steel	13.50 to 14.00
Frogs, switches and guards cut apart	15.50 to 16.00
Bundled sheet scrap	10.00 to 10.50

Per Net Ton	
Iron angle bars	\$15.00 to \$15.50
Steel angle bars	14.00 to 14.50
Iron car axles	20.00 to 20.50
Steel car axles	21.00 to 21.50
Wrought arch bars and transoms	17.00 to 17.50
No. 1 railroad wrought	14.50 to 15.00
No. 2 railroad wrought	14.00 to 14.50
Railroad springs	14.50 to 15.00
Steel couplers and knuckles	15.00 to 15.50
Locomotive tires, 42 in. and over, smooth inside	14.50 to 15.00
No. 1 dealers' forge	12.00 to 12.50
Mixed borings	8.50 to 9.00
No. 1 busheling	12.50 to 13.00
No. 1 boilers, cut to sheets and rings	10.00 to 10.50
No. 1 railroad cast scrap	13.00 to 13.50
Stove plate and light cast scrap	10.00 to 10.50
Railroad malleable	12.00 to 12.50
Agricultural malleable	10.50 to 11.00
Pipes and flues	10.00 to 10.50
Railroad sheet and tank scrap	10.00 to 10.50
Railroad grate bars	9.50 to 10.00
Machine shop turnings	10.00 to 10.50

New York

NEW YORK, Dec. 29, 1915.

Pig Iron.—A new phase of the situation is the buying of iron for prompt delivery by foundries whose ordinary supply would come over railroads which have embargoed pig iron and steel products. The Lehigh Valley Railroad, for example, is carrying pig iron from furnaces in eastern Pennsylvania to foundries in New Jersey whose supply of pig iron from Pennsylvania Railroad points has been cut off. On these prompt shipments the furnaces are naturally realizing prices above those they have quoted for forward delivery on good-size contracts which elicited competition. The week has seen no large new inquiry, in view of the holidays, apart from 10,000 tons for the General Electric Company for the second half of 1916. A Connecticut foundry bought 6000 tons for second half delivery, of which 2000 tons was high silicon and 4000 tons lower silicon iron. Of the 5000 to 10,000 tons of low-phosphorus iron inquired for by a New Jersey steel plant last week 4500 tons has been bought, deliveries extending over 1916. At Buffalo two-thirds or more of the 75,000 tons of resale iron that has been a factor in the market has been disposed of, most of it at prices ranging from \$17 to \$18 for No. 2 X. Buffalo furnaces are now selling at \$18 to \$20, according to grade and delivery. A New Jersey open-hearth steel works is in the market for 4000 to 5000 tons of basic iron. The embargo on coke into New England has been re-established by the New Haven road and some foundries there are on the verge of shutting down because of the shortage in supply of both coke and pig iron. We quote at tidewater as follows for early delivery: No. 1 foundry, \$19.75 to \$20.25; No. 2 X, \$19.50 to \$19.75; No. 2 plain, \$18.75 to \$19.25. Southern iron at tidewater, \$20 to \$20.50 for No. 1 and \$19.50 to \$20 for No. 2 foundry and No. 2 soft.

Ferroalloys.—British ferromanganese cannot now be obtained on contract for less than \$110, seaboard, producers having made an advance of \$10 per ton in the past week. Previous to this some spot material was reported sold at this figure, but now it is higher. There has been considerable selling recently at \$110

for delivery into the second quarter, and inquiry for small lots and over up to 1000 tons has been and is active. Some contracts have been closed for part of 1916. The market is tightening perceptibly and in some quarters anxiety as to future supplies is reported in view of consumption at a rate greater than ever before in the steel industry. Domestic producers, if they are selling, are doing so very quietly at as high as \$120 to \$125, furnace. The supply from this source is relatively not large. Spiegeleisen is very hard to obtain, producers being well sold up for some months to come. A cargo of 9000 tons of Indian manganese ore has just arrived for delivery to an eastern Pennsylvania steel company making ferromanganese. The demand for consumption of 50 per cent ferrosilicon continues very heavy.

Finished Iron and Steel.—The repeated statements of fair-sized lots being sold at prices considerably better than 2c., Pittsburgh, for shapes and bars lend weight to the claim that stock supplies are elastic in quantity. In short, there is a belief on the part of a number of consumers that, provided the price is high enough, material from fresh rollings finds its way to stock classifications, and the buyer desirous of the material considers the mill justified with the high prices reigning in other than the common domestic forms of finished steel. Investigation indicates that what volume is thus moving is a negligible quantity. The all-important question is how long the present congested state of seaboard railroad terminals is likely to last, as it is interfering not alone with exporting, but with domestic shipment, even along the routes of the leading lines from the steel mills. Meanwhile, mills are continuing manufacture of export materials at the regular rate and piling up stocks against the resumption of freight movements. The lull in fresh buying expected at this time is pronounced, but is not concerning the mills. Structural material is perhaps obtainable in somewhat less time than two or three weeks ago; chief expectation of quantity buying lies in railroad work. The Southern Railway has taken bids on 300 tons for repair shops at Knoxville, and the Cincinnati, Hamilton & Dayton on 400 tons for two bridges. Some 1100 tons for the C., H. & D. and the Baltimore & Ohio has been closed, probably with the Mount Vernon Bridge Company, and 250 tons for the Boston & Albany, 160 tons of this taken by the Boston Bridge Works and 60 tons by the New England Structural Company. The largest award of the week is for the McKean Street pier, Philadelphia, 5000 tons, awarded to the American Bridge Company, and other sizable building work closed includes 1700 tons for a paint works at Paulsboro, N. J.; 1500 tons for a powerhouse for the New York Steam Company, Burling Slip, awarded to Milliken Brothers, Inc., and 1500 tons for the Hudson County jail, Jersey City, N. J., awarded to the Fagan Iron Works. Some 400 tons at Anaconda for the Anaconda Copper Mining Company has also been closed. Light buying of plates at 2.25c., Pittsburgh, has been going on, and bar iron is in good demand, with no question about paying 1.90c., Pittsburgh. We quote mill shipments of steel bars at 2.169c. and higher for moderately prompt deliveries; plates, 2.419c., New York; structural shapes at 2.069c. and higher, New York, and iron bars at 2.069c., New York. For warehouse buying we quote iron and steel bars and structural material at 2.40c. and steel plates at 2.50c.

Cast-Iron Pipe.—Springfield, Mass., will open bids Dec. 21 on about 1000 tons. The feature of the market is the continued strong interest shown by private gas and water companies. Inquiries are numerous, and contracting for spring delivery is actively in progress. Prices are higher. Carload lots of 6-in., class B and heavier, are quoted at \$29 per net ton, tidewater, class A and gas pipe taking an extra of \$1 per ton.

Old Material.—The market situation appears to be gathering strength. Sales of heavy melting steel scrap have been made at \$18 delivered in the Pittsburgh district, and at least one consumer in eastern Pennsylvania is now willing to pay \$16, delivered, for lots of 1000 tons or more. Rolling mills making iron bars are

active buyers of stock suitable for their purposes. Brokers are paying about as follows to local dealers and producers, per gross ton, New York:

Railroad steel scrap or equivalent....	\$14.50 to \$15.00
Heavy melting steel scrap, yard stock (E. Pa. spec.).....	13.00 to 13.50
Relaying rails	21.50 to 22.00
Rerolling rails	16.00 to 16.50
Iron car axles	24.50 to 25.00
Steel car axles	26.50 to 27.00
No. 1 railroad wrought.....	19.50 to 20.00
Wrought-iron track scrap.....	17.00 to 17.50
No. 1 yard wrought, long.....	16.00 to 16.50
No. 1 yard wrought, short.....	15.50 to 16.00
Light iron	5.25 to 5.50
Cast borings	9.25 to 9.50
Wrought turnings	9.25 to 9.50
Wrought pipe	13.50 to 14.00
Old carwheels	13.75 to 14.00
Malleable cast (railroad).....	12.50 to 13.00

A peculiar situation has arisen among the local foundries because of their inability to secure satisfactory deliveries of pig iron and scrap which would ordinarily come over the railroads now congested with export traffic. The demand for cast scrap for this reason, as well as due to improved business in castings, has created a decided scarcity in this commodity for local consumption. It is stated that in some instances as high as \$17 has been paid for No. 1 cast. Dealers' usual quotations to consumers of cast scrap are as follows, per gross ton, New York:

No. 1 cast (machinery).....	\$16.00 to \$16.50
No. 2 cast (heavy).....	15.00 to 15.25
Stove plate	11.50 to 12.00
Locomotive grate bars.....	11.50 to 12.00

Buffalo

BUFFALO, N. Y., Dec. 28, 1915.

Pig Iron.—Practically the only iron now being offered for first-half delivery is re-sale iron, and there is only a small amount of this. Some consumers are manifesting interest in last-half iron, but as yet there is no general buying for that period. It is stated that in a few instances they have intimated a willingness to place such business without seeking competitive bids. Demand for the week has been phenomenally large, considering it is in the midst of the holiday season, with the inventory period approaching. The foundry coke situation is becoming very acute. Coke producers find it difficult to give consumers even the normal amount of coke used under ordinary circumstances. It is possible a good many foundries may be obliged to shut down temporarily, in whole or part, on this account. The report from Buffalo last week was delayed in the mails, so that no Buffalo pig-iron prices were published in THE IRON AGE of Dec. 23, but for the records it may be stated that the schedule of prices as of Dec. 21 was the same as the Dec. 28 prices below, for current and first-half delivery, f.o.b. furnace, Buffalo, except that the minimum for No. 1, No. 2 X and No. 2 plain was 25c. lower, or \$18 for No. 1, \$17.75 for No. 2 X and No. 2, \$17.50 for No. 3, etc. We quote, f.o.b. furnace, Buffalo, for first-half delivery as follows:

No. 1 foundry.....	\$18.25 to \$20.00
No. 2 X foundry.....	18.00 to 20.00
No. 2 plain	18.00 to 20.00
No. 3 foundry	17.50 to 20.00
Gray forge	17.50 to 20.00
Malleable	19.00 to 20.00
Basic	20.00
Charcoal, regular brands and analysis	21.00 to 22.00

Finished Iron and Steel.—Specifications for December covering bars, plates and shapes are reported to be in excess of those of any other month in the history of several of the district sales offices located in this territory. Few jobbers can report stocks in excess of normal requirements, and many of them report an almost sold-out condition. It is believed that an actual shortage of steel will exist during the first half of next year. Prices are no longer a governing factor, as customers are asking their regular sources of supply to allot them tonnage, prices to be fixed at a later date. The present asking price of 1.80c., Pittsburgh, with usual extras for bars, plates and shapes, is only nominal. Wire rods have been sold in limited quantities at \$44 per gross ton, f.o.b. cars, Pittsburgh. Tin-plate prices are advanced to \$3.75 base per 100 lb., 14 x 20-in.

prime cokes. Active conditions prevail in fabricated structural lines. The Charles F. Ernst Son's Iron Works have taken 500 tons for the Crosby office building, Buffalo; the Ferguson Iron & Steel Company 300 tons for plant extension for the International Acheson Graphite Company, Niagara Falls, and the Kellogg Structural Steel Company, Buffalo, 700 tons for the Municipal General Hospital, Buffalo. Bids are in on a New York Central bridge over the New York State barge canal at Rochester. The Lackawanna Steel Company has recently booked a considerable tonnage of steel rails, including 4000 tons for the International Railway, Buffalo; 4000 tons for the Cuban Railways, 5000 tons for the Burlington, and 3000 tons for the International & Great Northern.

Old Material.—Following the general advance in practically all lines, which took place a week ago, of 50 cents to \$1 per ton, there has been a further stiffening in the price of the following commodities: No. 1 railroad and machinery cast scrap; old steel axles, on which there was an advance of 50c. per ton, and an advance in bundled sheet tin of \$2.50 per ton. Trading in this commodity which is generally light in this territory owing to the limited production has shown a marked increase for the week. Heretofore three detinning interests have practically controlled the market, but recently a fourth consumer has come into the market to the advantage of the producers. One contract just closed at Buffalo covered a year's production of the seller and was placed at approximately \$16.50 per ton. The Canadian Government has placed an embargo on the exportation of steel and wrought scrap into the United States, effective Dec. 27. No objection is likely to be raised against the embargo on wrought scrap, but in the matter of steel scrap the situation is far different, as the mills of the United States, it is claimed, are shipping into Canada fully 75 per cent of the steel billets for shell making. Unless this order is modified it is stated that the American makers of billets going into Canada will be asked to stop the exportation of billets into Canada unless the scrap is permitted to flow back into this country where it is in strong demand. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel	\$16.50 to \$17.00
Low phosphorus steel	20.50 to 21.00
No. 1 railroad wrought	16.50 to 17.00
No. 1 railroad and machinery cast.....	15.25 to 15.75
Old steel axles	22.00 to 22.50
Old iron axles	22.00 to 22.50
Old carwheels	15.25 to 15.75
Railroad malleable	15.25 to 15.75
Machine shop turnings	7.75 to 8.25
Heavy axle turnings	12.00 to 12.50
Clean cast borings.....	9.25 to 9.75
Iron rails	17.00 to 17.50
Locomotive grate bars	11.00 to 11.50
Stove plate (net ton).....	9.50 to 10.00
Wrought pipe	13.00 to 13.50
Bundled sheet scrap	12.00 to 12.50
No. 1 busheling scrap.....	13.50 to 14.00
No. 2 busheling scrap.....	11.00 to 11.50
Bundled tin scrap.....	15.00 to 15.50

Emergency Shipping of Motor Trucks

On account of the recent shortage of regulation automobile box cars, the Packard Motor Car Company, Detroit, Mich., has pressed flat cars into service for the shipment of its motor trucks. In shipping the trucks in this way the two vehicles which constitute the load for one car are placed so that the front ends occupy the center of the car. The trucks are blocked in place and anchored by heavy timbers and are then provided with a frame of lumber which is subsequently covered with a sheathing of oilcloth.

The Cincinnati Iron & Steel Company, Cincinnati, Ohio, held its annual meeting Dec. 21. Reports submitted by the officers showed that the first half of 1915 was a rather lean period, but that it was offset by the excellent record made in the last five months, while the coming year is expected to be a very busy one. The usual dividend was paid. All officers were reelected as follows: President, James I. Stephenson; vice-president, H. C. Busch; secretary and treasurer, James A. Sebastiani.

British Market Unchanged

Quotations Mostly Nominal—Sheet and Steel Bars Higher

(By Cable)

LONDON, ENGLAND, Dec. 29, 1915.

There has been no change of any consequence in iron and steel conditions in the last week. Quotations, which are largely nominal, are as follows:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 21s. 9d. to 25s. 3d., compared with 24s. 6d. to 25s. one week ago.

Cleveland pig-iron warrants, 77s. 10d., against 76s. 6d. one week ago.

No. 3 Cleveland pig iron, maker's price, f.o.b. Middlesbrough, 76s. 9d.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £17 nominal.

Steel ship plates, Scotch, delivered local yards, £11 5s.

Steel rails, export, f.o.b. works port, £11 5s.

Hematite pig iron, f.o.b. Tees, 130s. to 135s.

Sheet bars (Welsh), delivered at works in Swansea Valley, about £12, against £11 last week.

Steel joists, 15 in., export, f.o.b. Hull or Grimsby, nominal and unquotable, against £12 5s. as the last quotation.

Steel bars, export, f.o.b. Clyde, £16 10s., compared with £15 5s. a week ago.

Ferromanganese, f.o.b., £20 15s.

Ferrosilicon, 50 per cent, c.l.f., £27.

Transportation Problem Serious — Maximum Prices for Iron—Semi-finished Steel Dead-locked

(By Mail)

LONDON, ENGLAND, Dec. 15, 1915.—Prices appear to advance strongly and it is only guesswork as to how far the rise, which has now been so long in progress, may be carried. Each week sees greater and greater difficulties in dealing with business, whether in ore, pig iron, or finished steel. In all cases the question of transport is becoming a practically insolvable problem. Not only has the railroad system of the country practically broken down for all commercial purposes, but shipping gets worse and worse, not only because of the shortage of vessels, but because of the inordinate delay which shipowners have to face at ports of discharge. The whole question is a matter of labor, and the plain truth is that there is no longer anything like the quantity available in this country to deal with existing business. The entire energies are being centered more and more upon the war and it is safe to say that in another few months general trade in many branches will have come to a complete standstill.

There is a good deal of discussion regarding the suggested limitations of pig-iron prices and there is a feeling that the Government should regulate selling prices. The present position is brought about entirely by causes over which furnace owners have no control. If the government does regulate the price of pig iron it will be obviously unable to regulate the price of Spanish ore, and it would be a manifest injustice to fix east coast hematite at about 130s. a ton, while Spanish ore might go to any figure. Here, of course, we come back to the old freight question, and this in its turn involves the entire policy of government chartering. It is alleged in the ore trade that there is any amount of material available at reasonable prices, but that it is impossible to ship it except at extortionate freight rates. The ship owners assert that the freights are not extravagant but are based upon the state of congestion and the practical absence of discharging facilities at all the principal ports. And there, probably, the matter must be left. Meantime the suggestion is made that Cleveland foundry iron should be fixed at 75s. a ton maximum, east coast hematite at 130s. and west coast at 137s. a ton maximum. The whole position is mixed up with all sorts of considerations which render definite action difficult. Makers of pig iron, especially hematite, are fully sold for a considerable time ahead, and it becomes a matter of

increasing difficulty to place contracts for delivery over the first three months of next year. Coke is very scarce, and dear, but even yet the tendency appears to be in an upward direction.

In semi-finished steel business is practically at a dead-lock. The South Wales makers have only limited quantities available for sale since their attention is primarily centered upon munitions and where they are in a position to sell, as much as £10 10s. a ton has been realized for billets and sheet bars delivered locally, while makers will not entertain any business whatever for delivery outside their own district. East coast steel works have sold sheet bars to works in the Liverpool district at £10 10s. a ton delivered, and this seems to be the ruling figure, but only limited quantities are to be picked up at the price and where anything special is required prices are a matter of bargaining. There is practically nothing doing in American steel, but here and there where material is being shipped against old contracts there are resale parcels, and in this direction odd sales of a few hundred tons have been done within the last few days at \$52 for 4-in. billets c.i.f. Glasgow, January shipment.

In finished iron and steel prices are mounting skywards and it is almost impossible any longer to name quotations, as works have practically nothing to sell, and individual bargaining comes into operation where business is submitted. The current home trade price for joists is probably about £12, but this figure is only given as an indication as to what might possibly be accepted. Sheets are all sorts of prices and so are hoops. Government work is absorbing the whole bar-iron output and the tendency appears to be upward, with labor costs steadily rising.

Metal Market

NEW YORK, Dec. 29, 1915.

The Week's Prices

Cents Per Pound for Early Delivery									
Copper, New York		Tin, New York		Lead, New York		Spelter, New York		St. Louis	
Dec.	Lake	Electrolytic	York	New	St.	York	St.	York	St.
22.....	21.00	20.50	38.75	5.40	5.32½	17.50	17.25		
23.....	21.00	20.87½	38.87½	5.40	5.32½	17.50	17.25		
24.....	21.25	21.12½	39.12½	5.40	5.32½	17.30	17.15		
27.....	21.50	21.50	39.12½	5.40	5.32½	17.40	17.15		
28.....	22.25	22.25	39.25	5.40	5.32½	17.50	17.25		

Copper has advanced 2c. per lb. and the demand is heavy after what is probably the largest individual transaction on record. Tin is lower and its activity has been confined to futures. Lead is strong with the export demand especially good. Spelter has been quiet and its quotation is unchanged. Prompt antimony is scarce and stronger.

New York

Copper.—Since Dec. 22 the market has been excited and each day has seen substantial advances. On that day the British Government closed with two sellers for 120,000,000 lb. of electrolytic to be delivered at the rate of 5000 tons a month throughout 1916. It is the opinion of the trade that the deal is the largest individual transaction in copper ever made. The price paid is not definitely known, but is believed to have been between 20.50c. and 21c. The purchase was made at a time when the market was fairly active, and when it became known both domestic and foreign buyers became more energetic than ever. The market was quoted yesterday at 22.25c., at which figure sales were made late in the day, and 22.50c. was then asked. Both Lake and electrolytic are on the same price level, but Lake is purely nominal. Large sales were made all the way up to yesterday's price, and every day was active except Monday which was a holiday in London. On that day sellers were asking 22c., full terms. Deliveries this side of April are rather difficult to secure inasmuch as some of the large agencies are sold up. It is doubtful if they have ever been so heavily sold ahead as at present. Members of the trade say that nothing would surprise them, and that if the demand holds up, the metal will surely go to 25c. The independent brass mills withdrew prices on their products this week.

Sheet copper can be had at about 27c., base. The exports this month show a decided improvement, amounting to date to 26,382 tons.

Tin.—On the whole the market has been quiet, particularly with regard to spot. Monday being a holiday in London was a factor in lessening activity. What business there has been was largely in tin afloat or to be shipped from the Far East. Of these deliveries about 300 tons was dealt in Dec. 23, both dealers and consumers doing the buying. On Monday about 150 tons of the same positions changed hands and more would have been done had London been selling on that day. Yesterday similar business was done to the extent of 200 to 300 tons, but there were few sellers. The spot quotation yesterday was 39.25c. The arrivals this month total 3847 tons, and there is now afloat 5618 tons.

Lead.—About the middle of last week resale lots of lead were bought up and the market became considerably stronger. The export demand is heavy and premiums have been offered. In one case a bid of 5.50c., New York, for 500 tons for January shipment to a foreign country was turned down. According to reports, stocks have been considerably reduced and all the sellers are well booked ahead. Some of them want premiums for prompt shipments. An advance is looked for. The exports this month total 6563 tons.

Spelter.—This metal has not shared the excitement in copper. A week ago offerings were a little freer and subsequently prices became a little easier. In the absence of trading in London over the Christmas holidays the market was quiet here, but it has since grown a little firmer and inquiry is good for prompt shipment metal which is scarce. Neither here nor abroad consumers incline to buy any further ahead than they can help at existing prices. February is quoted at about 16c., March at 15.50c. and April, May and June at 14c. to 14.25c. The exports this month amount to 5691 tons.

Antimony.—Spot metal is scarce and the market is strong at 39.50c., duty paid, for Chinese and Japanese grades. January and February shipments from the Far East are quoted at 32.75c. to 33c. in bond.

Aluminum.—The market for No. 1 aluminum, 98 to 99 per cent pure, is quoted at 54c. to 55c. Business is quiet.

Old Metals.—In sympathy with the advance in new copper, all classes of copper and brass scrap are higher. Dealers' selling prices are as follows:

	Cents per lb.
Copper, heavy and crucible.....	19.50 to 20.00
Copper, heavy and wire.....	19.00 to 19.50
Copper, light and bottoms.....	17.00 to 17.50
Brass, heavy.....	13.00 to 13.50
Brass, light.....	11.00 to 11.25
Heavy machine composition.....	15.50 to 16.00
No. 1 yellow rod brass turnings.....	13.00 to 13.50
No. 1 red brass or composition turnings.....	13.50 to 14.00
Lead, heavy.....	4.75
Lead, tea.....	4.50
Zinc.....	11.00 to 12.00

Chicago

DEC. 27.—The large purchases of copper for Great Britain have sent quotations to the highest levels in nearly a decade. In the other metals the season of holiday quiet rules the market. We quote: Casting copper, 21c.; Lake copper, 22c.; tin, carloads, 40c.; small lots, 42c.; lead, 5.35c.; spelter, 17.25c.; sheet zinc, nominally, 22c.; Cookson's antimony, 50c.; other grades, 42c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 16.75c.; copper bottoms, 15.75c.; copper clips, 16.50c.; red brass, 14.50c.; yellow brass, 12.50c.; lead pipe, 4.50c.; zinc, 13c.; pewter, No. 1, 24c.; tinfoil, 30c.; block tin pipe, 34c.

St. Louis

DEC. 27.—Prices were generally firm and for the most part higher the past week, but conditions were quiet. Lead closed to-day at 5.55c.; zinc, 19c.; tin, 42c.; Lake copper, 21c.; electrolytic copper, 21c.; Asiatic antimony, 44c. In the Joplin ore district the top price paid for zinc blende was \$116, and the general range was \$85 to \$115 per ton. Calamine was in good demand at \$65 to \$90. Lead ore was strong at \$70. The average

values per ton for the week's sales were as follows: Zinc blende, \$96.70; calamine, \$64.10; galena (lead), \$67.06. Miscellaneous scrap metals are quoted as follows: Light brass, 7.50c.; heavy yellow brass, 9.50c.; heavy red brass and light copper, 11c.; heavy copper and copper wire, 13c.; zinc, 7.50c.; lead, 4c.; tea lead, 3.50c.; pewter, 21c.; tinfoil, 30c.

Iron and Industrial Stocks

NEW YORK, Dec. 19, 1915.

With no specially unfavorable features, but with most developments of an encouraging character, prices of stocks the past week displayed a tendency to advance. United States Steel common, which sold up to 89½, attained a higher price than at any time in the past six years. The range of prices on active iron and industrial stocks, from Wednesday of last week to Tuesday of this week, was as follows:

Allis-Chal., com..	31½ - 32¾	Republic, com..	53¾ - 56¾
Allis-Chal., pref..	82 - 85½	Republic, pref..	109¼ - 110¾
Am. Can., com..	59¾ - 62	Sloss, com..	62 - 64½
Am. Can., pref..	110¾ - 111½	Sloss, pref..	99 - 99½
Am. Car & Fdy., com..	77 - 79¾	Pipe, com..	23½ - 26½
Am. Car & Fdy., pref..	116¾ - 117½	Pipe, pref..	48 - 50
Am. Loco., com..	68½ - 71	U. S. Steel, com..	85¼ - 89½
Am. Loco., pref..	101¼ - 101½	U. S. Steel, pref..	116¾ - 117
Am. Steel Fdries. 61 - 63		Va. I. C. & Coke. 63½ - 67	
Bald. Loco., com..	115½ - 121	West. Electric.. 68½ - 71	
Bald. Loco., pref..	108½ - 108½	Am. Rad., com..	387½ - 390
Beth. Steel, com..	460 - 472	Am. Ship, com..	35¾ - 36½
Beth. Steel, pref..	145 - 145	Chic. Pneu. Tool. 77 - 78½	
Case (J.I.), pref..	85 - 85	Cambria Steel.. 74¼ - 75½	
Colorado Fuel... 50¾ - 54		Lake Sup. Corp.. 9¼ - 10	
General Electric. 173 - 175		Pa. Steel, pref..	82 - 84½
Gt. No. Ore Cert. 48 - 51½		Warwick..... 10¼ - 10½	
Int. Harv. of N. J., com..	110 - 112½	Cruc. Steel, com..	72½ - 75½
Int. Harv. of N. J., pref..	119½ - 119¾	Cruc. Steel, pref..	110½ - 111
Int. Harv. Corp., com..	80 - 80¼	Harb.-Walk. Refrac., pref..	100
Lackawanna Stl. 80¼ - 82¾		La Belle Iron, com..	50½ - 54
N. Y. Air Brake.. 136¼ - 139¼		La Belle Iron, pref..	123
Nat. En. & Stm., com..	28½ - 29½	Am. Brit. Mfg., pref..	80
Nat. En. & Stm., pref..	95 - 95½	Can. Car & Fdy., com..	85 - 91
Pitts. Steel, pref..	95	Can. Car & Fdy., pref..	102 - 107
Pressed Stl., com..	64 - 65½	Carbon Stl., com..	65 - 71
Ry. Steel Spring, com..	44 - 45½	Driggs-Seabury. 141 - 145	
		Midvale Steel.... 72 - 79½	

Dividends

The Otis Elevator Company, regular quarterly, 1½ per cent on the preferred and 1¼ per cent on the common stock, payable Jan. 15.

The Steel Company of Canada, 3½ per cent on account of back dividends on the preferred stock, in addition to regular quarterly of 1¼ per cent on the issue.

The Gulf States Steel Company, 15 1/6 per cent on the first preferred stock, being the dividends accumulated thereon to Jan. 1, 1916, payable Feb. 15.

The Reo Motor Car Company, in addition to the stock dividend of 100 per cent recently announced, an extra cash dividend of 2½ per cent, both payable Jan. 10.

The Westinghouse Electric & Mfg. Company, regular quarterly 1½ per cent on the common and 1¾ per cent on the preferred stock, the former payable Jan. 31 and the latter Jan. 15.

The Pittsburgh Coal Company, regular quarterly, 1¼ per cent on the preferred stock, payable Jan. 25.

The Scovill Mfg. Company, extra 5 per cent in addition to the usual quarterly 2 per cent, payable Jan. 1.

The Canadian Crocker-Wheeler Company, semi-annual, 3½ per cent, payable Dec. 31.

The Canadian General Electric Company, regular quarterly, 1¾ per cent on the common stock, payable Jan. 1.

The American Screw Company, regular quarterly, 1½ per cent, and special of 1 per cent, payable Dec. 31, making 10 per cent for the year. Two years ago the dividend was reduced to 6 per cent per annum.

The Garry Iron & Steel Company, Cleveland, which has been in business 45 years, will be discontinued and its business will hereafter be conducted under the name of the Brier Hill Steel Company, of which it has been a subsidiary since the organization of the latter company. The Garry Company, for a number of years, has operated the Empire sheet mills at Niles. The Brier Hill Steel Company will open a sales office in the Rockefeller Building, Cleveland, Jan. 3. J. C. Wicks, now president and general manager of the Garry Iron & Steel Company, will have charge of this office as district sales manager.

By-Product Coke Plant at Cleveland

The American Steel & Wire Company will begin work early in the new year on a by-product coke plant consisting of 200 ovens, which will be erected at Cleveland in connection with its Central blast furnaces.

Prohibition of Scientific Shop Management at Army Arsenal

WASHINGTON, D. C., Dec. 28, 1915.—In his forthcoming annual report Gen. William Crozier, chief of the Ordnance Bureau of the War Department, reviews in detail the effect of the prohibition of scientific shop management at the arsenals by the army appropriation act. As this legislation did not forbid piece-work payment, the work at the Frankford Arsenal, which lends itself readily to payment on the piece basis, was practically unaffected by the law. The work at the Watertown Arsenal can not be done on the piece-work system, but is done principally under appropriations carried, not in the army appropriation act, but in the fortifications act, to which the prohibitive legislation in the army act does not apply. The system of premium payment has therefore been continued at the Watertown Arsenal and the employees have not been directly affected by the new legislation, with the exception of a few unfortunates who are engaged in the hauling of supplies for the Quartermaster's Department, whose pay as a consequence has been reduced by the loss of premiums. As the officers of the department are the ones who have been directing the taking of time studies at the Watertown Arsenal and are paid out of appropriations carried in the army act, the legislation has been effective in prohibiting the making of time studies and they have therefore ceased.

Referring to the reports of the United States Commission on Industrial Relations upon scientific shop management, General Crozier expresses regret that the commission has not seen fit to state definitely its conclusions regarding the system in operation at the Watertown Arsenal, although a committee of experts employed by the commission made a thorough investigation of that establishment.

Commenting on the report of Basil M. Manly to the commission, in which the deduction is made that one of the effects of scientific management on the skilled crafts will be a leveling one, diminishing the difference between the wages for highly trained craftsmen and those for semi-skilled workmen or specially trained handy men, General Crozier says:

At the Watertown Arsenal the records show that the leveling effect has not appeared, and that the employees of the higher grades have benefited more from the application of those features of scientific management which directly affect the workman at all than have the lower grades of semi-skilled or handy men. . . . The exposure of the skilled trades to the competition of common labor may be readily understood as something which these trades would necessarily oppose, but such competition, if successful, would undoubtedly increase production, to the advantage of consumers, and would also improve the lot of the competing laborers, who exceed in numbers the skilled individuals with whom they would thus be brought into competition. I do not myself find in the practice of scientific management in this department any sign of relief from the necessity for highly skilled workmen in at least the proportion in which we have heretofore employed them, but if I should meet such a possibility I would not consider that the advantages of greater ease of production and improvement of the lot of less skilled workers would be offset by any supposed advantage in the maintenance of an unnecessarily large proportion of highly skilled craftsmen.

General Crozier devotes a chapter of his report to the practical operation of the Taylor system of scientific shop management at Watertown, in which he says that, while no new evidence has made its appearance in the operations of the past year, nevertheless all the advantages which have heretofore shown themselves "have continued to prevail and the spirit of co-operation and cheerful industry which has shown itself in the everyday conduct of the Watertown Arsenal leaves little to be desired."

W. L. C.

BRITISH STEEL EXPORTS

November Figures Show Little Change from October—Imports Still Low

British exports of iron and steel for November, while a little less than for October, are larger than for August and September. Excluding iron ore and scrap the total for November was 304,169 gross tons against 307,040 tons in the preceding month and 237,374 tons in November, 1914. For the 11 months to Dec. 1, 1915, the total was 2,943,838 tons against 3,668,631 tons to Dec. 1, 1914, a decrease of 20 per cent. Pig-iron exports to Dec. 1, 1915, were 446,366 tons, against 637,764 tons to Dec. 1, 1914. Of the total France took 115,919 tons and Italy 106,125 tons. November exports were 77,958 tons against 40,465 tons in November last year.

Steel-bar exports in November were 58,121 tons, against 14,591 tons in November, 1914. France took 46,447 tons last month. For the first 11 months of this year the total was 453,426 tons, France taking 322,847 tons. For the first 11 months of this year exports of galvanized sheets were 273,946 tons, against 544,261 tons to Dec. 1, 1914. For November this year they were only 16,824 tons, compared with 25,495 tons in November, 1914.

Ferromanganese exports in November were about 8000 tons. To Dec. 1 they were about 90,000 tons, as against about 111,000 tons to Dec. 1, 1914. In September they were about 6500 tons and in October 8000 tons. Exports of rails were 12,760 tons last month, against 16,181 tons in November last year. For the first 11 months of this year they were only 232,352 tons, against 419,125 tons to Dec. 1, 1914.

British imports of iron and steel, excluding iron ore and scrap, were 95,103 gross tons in November, against 94,265 in October and 54,595 tons in November, 1914. The decrease is shown by the imports in August and September which were 134,713 tons and 120,863 tons respectively. For 11 months to Dec. 1, 1915, they were 1,090,760 tons, against 1,557,243 tons to Dec. 1, 1914. To Dec. 1, iron ore imports were 5,609,914 tons, against 5,340,348 tons for 11 months of last year. Imports of crude zinc were 5040 tons in November this year, against 6432 tons in November, 1914. For the 11 months to Dec. 1, 1915, they were 71,145 tons, against 105,271 tons to Dec. 1, 1914.

Railroad Car Business

Expectation of January buying of railroad cars continues higher but meanwhile anything from the Pennsylvania or Illinois Central looks remote and to be added to list of railroads which shy at present prices is the Chicago, Burlington & Quincy, which has been regarded as an early purchaser of some 54 passenger equipment cars. Before the end of the week it is expected that the Missouri, Kansas & Texas will close for 1500 gondolas, the Denver & Rio Grande for 1000 box and the Chicago Great Western for 500 box cars. The Duluth & Iron Range has bought 100 flat cars of the American Car & Foundry Company, which company is to build 25 tank cars for the American Zinc, Lead & Smelting Company and is believed to have taken 1000 underframes for the Delaware & Hudson. The Lehigh & New England has closed for 750 cars. The Bethlehem Steel Company is in the market for 100 gondolas and the Bethlehem-Chile Iron Mines Company for 25 ore cars.

The Bessemer & Lake Erie is to buy 2000 ore cars. Rumors that the Pennsylvania is quietly buying cannot be substantiated.

Ferromanganese Imports in November

Ferromanganese imports from England into the United States in November were 4069 gross tons, according to Government figures. Of this 1746 tons came in at Philadelphia and 1558 tons at Baltimore. The October imports were 4326 tons.

Large Midvale Contract for French Shells

The Midvale Steel Company has closed in the past week a contract with the French Government for 384,000 shells, ranging in size from 8.8 to 11.8 in., all for delivery in the coming year. The contract amounts to \$28,000,000 to \$30,000,000.

Pittsburgh and Nearby Districts

The William B. Pollock Company, Youngstown, Ohio, has received a contract from the Republic Iron & Steel Company to build a blast furnace, which will be No. 5. It is to be erected on a line with the Nos. 2, 3 and 4 stacks, which the Pollock Company has also built. *The No. 5 stack will in time replace the present hand-filled No. 1 stack, but the latter will operate through its present blast at least. The new furnace will have a daily capacity of 500 tons, but its exact dimensions have not yet been settled. The Pollock Company is also building a large amount of plate work for the American Tar Products Company, Struthers, Ohio, for tanks and other appliances to take care of the tar products from the new Koppers by-product coke ovens now being built by the Youngstown Sheet & Tube Company.

The Driggs-Seabury Ordnance Company, Sharon, Pa., owing to many orders on its books, is now operating its plant on an eight-hour schedule, working three shifts daily. The company expects within the next few months to increase its working force largely. It is reported to have received orders for a large number of 3-in. guns for the Allies.

The Ohio Iron & Steel Company, operating Mary furnace at Lowellville, Ohio, has paid a Christmas bonus to its 140 employees amounting to about 5 per cent of their wages.

Dr. F. B. Hess and S. A. Carson have been appointed receivers of the Harris-Smith Coal & Coke Company, Uniontown, Pa. The receivership was granted on the petition of the Brewing Coke Company and Lloyd H. Smith to cover an indebtedness of \$30,000, representing a mortgage of the corporation. The unsecured indebtedness is \$24,500, and assets are placed at \$3,988.

The Brier Hill Steel Company, recently incorporated at Albany, N. Y., with a capital of \$10,000, will succeed the Garry Iron & Steel Company of New York about Jan. 1. The Garry Company is the New York State subsidiary of the Brier Hill Steel Company of Youngstown, Ohio. It is the intention of the Brier Hill Company to have all its subsidiaries bear the same name as its own. It has subsidiaries in Cleveland, Chicago, San Francisco and other cities.

The William Tod Company, Youngstown, Ohio, has filed a certificate with the Secretary of State of Ohio reducing its capital stock from \$600,000 to \$6,000. Some time ago another corporation known as the William Tod Company was incorporated with a capital stock of \$1,000,000 common stock and \$500,000 preferred, which succeeded to the interests of the former William Tod Company. The present is merely legal action winding up the affairs of the old corporation.

The Youngstown Sheet & Tube Company, Youngstown, Ohio, has put out some interesting figures regarding its consumption of raw materials in a year's operations and its annual capacity for the manufacture of different products. The figures are as follows: Area of buildings, 6,894,000 sq. ft.; annual consumption of ore, 1,500,000 tons; coke, 850,000 tons; limestone, 375,000 tons; pig iron, 1,550,000 tons; daily consumption of gas, 225,000,000 cu. ft.; water, 200,000,000 gal.; annual capacity for production of coke, 850,000 tons; Bessemer and open-hearth steel ingots, 1,500,000 tons; sheet bars, billets and slabs, 1,250,000 tons; skelp, 660,000 tons; merchant bars, 200,000 tons; tubular goods, 500,000 tons; sheets, 100,000 tons; wire products, 130,000 tons; puddled iron muck bar, 40,000 tons. Number of freight cars annually required in operation of the works, 280,000.

PERSONAL

Andrew J. Sloper has resigned as secretary of the American Hardware Corporation, New Britain, Conn., to relieve himself of some of the increasing details of his business interests. He was one of the prime movers in the formation of the corporation, representing the Russell & Erwin interests. In accepting his resignation, the directors voted thanks to him for his able and faithful performance of the duties and responsibilities of his office. He is succeeded by George T. Kimball, who will combine the offices of auditor and secretary.

R. L. Mason, for fourteen years manager of the railroad department of Hubbard & Co., Pittsburgh, has resigned, effective Jan. 1. He will engage in the railroad supply business on his own account, with offices in room 1501 Oliver Building, Pittsburgh.

Thomas F. Fournier, chief engineer, and Albert Vuilleumier, assistant chief engineer, of the Becker Milling Machine Company, Hyde Park, Boston, Mass., have resigned. Mr. Fournier will be general manager and Mr. Vuilleumier works manager of the Standard Machinery Company, Mystic, Conn.

W. P. Cartwright, formerly of the Anderson Forge & Machine Company, Detroit, will go with the Buick Motor Car Company, Flint, Mich., at the beginning of the year as forge tool designer and in charge of the die room.

L. V. McKesson and George L. McKesson have sold their interests in the Standard Steel Tube Company, Toledo, Ohio, to George B. Storer and P. E. Chase. Mr. Storer, who has been vice-president and manager, has succeeded L. V. McKesson as president.

The following men of business prominence will be on the directorate of the new Haskell & Barker Car Company: Ambrose Monel, president International Nickel Company; William E. Corey, president Midvale Steel & Ordnance Company; Frank A. Vanderlip, president National City Bank; E. S. Webster of Stone & Webster, Boston; John Morron, president Atlas Portland Cement Company; J. W. Harriman, president Harriman National Bank, and Arthur O. Choate of Potter, Choate & Prentice.

Harry Wilk, recently with *Men's Wear* and *Chicago Apparel Gazette*, has resigned to become associated with the Moller & Schumann Company, Brooklyn, N. Y., manufacturer of Hilo varnishes and enamels, as assistant to Carl J. Schumann, sales and advertising manager of the company, and will give particular attention to the sales promotion and dealers' service end of that department. The editing of the *Hilo World*, preparation of trade paper copy, supervision of printing, etc., will continue in charge of E. B. Mix, who has been in the sales and advertising department for some time.

Kelly, Cooke & Co. have recently opened offices in the Drexel Building, Philadelphia, Pa., to conduct a general engineering practice in the public utility and industrial fields, including the investigation of industrial situations to develop ways and means for reducing manufacturing costs. William F. Kelly, senior member, received the degree of mechanical engineer from the University of Pennsylvania in 1893, for several years thereafter was on the engineering staff of the Union Traction Company, Philadelphia, and from 1901 to 1915 was a member of the staff of Ford, Bacon & Davis. Charles B. Cooke, Jr., was also graduated from the University of Pennsylvania, entered the shops of the Westinghouse Machine Company, East Pittsburgh, working up to the position of assistant commercial engineer, which he occupied for two years prior to joining the staff of Ford, Bacon & Davis.

The Lehigh Valley Railroad announces the appointment of William L. Donaldson as assistant general freight agent at Buffalo, succeeding Samuel A. Story,

who has resigned to engage in commercial work with a large importing firm in New York City. Mr. Story's resignation was accepted with regret. Mr. Donaldson entered the railroad service eighteen years ago.

C. F. Batchelder, John Deere Plow Company, St. Louis, has been elected president of the Implement, Vehicle and Hardware Association of that city, with Ernest Lewis, John W. Brewer and E. L. Galt as vice-presidents, and G. T. Michael secretary-treasurer.

Clarence H. Howard, president Commonwealth Steel Company, St. Louis, has been selected by the nominating committee of the local Business Men's League for president of that organization, which includes about 3000 of the leading business houses of the city in its membership. The nomination is equivalent to election, there being no opposition.

James W. Hitchcock, assistant general manager of sales of the Phillips Sheet & Tin Plate Company, Weirton, W. Va., has resigned, effective Dec. 31, and will retire from the tin-plate business.

President A. C. Dinkey, Philadelphia, announces that, effective Jan. 1, John C. Neale has been appointed general manager of sales for the Midvale Steel Company and the Worth Brothers Company. Mr. Neale will have complete charge of all sales matters and will be located at the general offices of these companies in the Widener Building, Philadelphia.

G. R. Heisler has severed his connection with Morris Weil's Sons, effective Jan. 1, and has opened offices in the Drexel Building, Philadelphia, the firm name being G. R. Heisler & Co., to buy and sell iron and steel, making a specialty of iron and steel scrap.

Locomotive and Car Orders

Orders for 83 locomotives and inquiries for 45 have been reported in the past two weeks. The Chicago & Great Western has ordered 10, the Lehigh Valley 10 and the Union Railroad 5 locomotives from the Baldwin Locomotive Works. The American Locomotive Company will build 10 locomotives for the Cuban Railroad, 7 for the Chesapeake & Ohio and 6 for the Minneapolis, St. Paul & Sault Ste. Marie. The Norfolk & Western will build 8 in its own shops. The Lehigh Valley is inquiring for 15 more locomotives and the Delaware, Lackawanna & Western will buy 17. Estimates place the December locomotive orders at 107 up to Dec. 27, making a total for the year to that date of 1972.

Car orders to Dec. 27 are figured to have reached a total of 6944, making 69,106 ordered between July 1 and that date.

Larger British Imports of Manganese Ore

Manganese ore imports into Great Britain in November were the largest with one exception since the war started. They were 67,308 gross tons, the largest war importation being 78,156 tons in August, 1914. They have been particularly heavy the last three months, 45,045 tons in August, 60,931 tons in September which, with the November imports, make 173,284 tons for these three months. This is more than double the importations for the first eight months of the year, which were 164,769 tons. The imports for 11 months to Dec. 1, were 338,053 tons, against 446,205 tons to Dec. 1, 1914.

American Semi-Finished Steel in Great Britain

Great Britain's imports of blooms, billets and slabs in November were 16,964 gross tons, against 1264 tons in November, 1914. For the 11 months to Dec. 1, 1915, they were 329,606 tons, compared with only 24,633 tons to Dec. 1, 1914. For the 16 months of the war, from Aug. 1, 1914, to Dec. 1, 1915, total imports from the United States, were 338,948 tons, against 27,506 tons for the same period a year previous, or at the rate of 22,600 tons per month, against 1834 tons previously.

AMERICAN TIN-PLATE EXPORTS

British Sheet and Tin-Plate Industries Menaced by the Situation

Commenting on certain phases of Great Britain's steel output and export problems, the *London Iron and Coal Trades Review* says:

As things are, rapid inroads are being made by our great American competitor into markets formerly exclusively British. The figures of the Bureau of Foreign and Domestic Commerce of the United States for September make this remarkable showing:

	Exports from the United States in Tons			
	September,		Nine Months,	
	1914	1915	1914	1915
Iron and steel plates and sheets	6,210	30,780	90,835	181,000
Galvanized iron sheets and plates	3,242	6,222	30,191	64,018
Tin and terne plates	4,726	22,271	44,784	105,065

The Welsh tin-plate industry had built up a large export trade with foreign countries other than the United States, and for years the quality and price of its tin plate were unchallengeable, but the figures quoted show American exports of tin plate for September last to have been 22,271 tons, against the total British exports for the same period of 20,000 tons, or 2271 tons more than the British exports. These facts should compel attention, and bring home the seriousness of the position of the finished steel industries. They show clearly that failure to supply present customers from any cause must mean permanent loss of existing business and ought to drive home the words of Beaumont Thomas, one of the South Wales manufacturers, to the effect "that the question of the hour is how to increase steel output."

At the beginning of October steel tin bars were quoted at £7 per ton, and at the present moment (Dec. 3, 1915) the official price in South Wales is £9 10s. per ton, with a premium obtainable, and with supply far from being assured. It is easier to trace the effect of this state of affairs in the tin-plate than in the galvanized industry, which latter is of course affected also by the remarkable course of the spelter market. At the beginning of October a box of tin plate, 108 lb., at Swansea, was quoted at 17s. 6d., while now the price is 22s. 6d. per box, which is higher than was obtained for tin plates in 1891, the boom year of the McKinley tariff and is the highest since 1880.

We thus see that the high price of and demand for sheet and tin-plate bars in South Wales, and the inability of sheet and tin-plate manufacturers to secure foreign supplies menace the prosperity of their industries.

Better Relations Between Railroads and Patrons

Indications of an improvement in many respects in the relations between the railroads and their patrons are shown in the recent annual report of the Interstate Commerce Commission, according to the *Railway Age Gazette*. Not only has there been a large reduction in the number of complaints, but the report of indictments returned for violations of the interstate commerce laws shows that the railroads are more law-abiding than the shippers or the traveling public.

In the year ended Oct. 31, 1915, the commission received 964 formal complaints, a decrease as compared with the previous year of 190, and as compared with 1913 of 59. It also received 6500 informal complaints, as compared with 7880 the year before and 7600 in 1913. The cases involve not so much dissatisfaction with the amount of the rates as market rivalry between competing cities.

Of the 72 indictments returned during the year at the instigation of the commission, only 22 were against carriers or carriers' agents and 50 were against passengers, shippers or other interested parties. In every year but two since the commission's division of prosecution was organized in 1907, there have been more indictments of shippers and passengers for soliciting and receiving rebates, or other preferential treatment, false billing of shipments, filing false claims and for violations of the anti-pass act, than of the railroads for giving favors.

OBITUARY

Henry Wick

Henry Wick, for many years prominent in the manufacture of pig iron and steel in the Youngstown (Ohio) district, died at his home in that city on Wednesday afternoon, Dec. 22, aged 69 years. He was educated in the public schools at Youngstown, a private school at Sewickley, Pa., and later in college at Hudson, Ohio. He early showed an aptitude for business, and his first occupation was running a coal mine at Youngstown. Later, he was connected with the Packard Coal Com-



HENRY WICK

pany and was a member of the firm of Wick & Wells, coal operators. Entering the iron industry, he became secretary and treasurer of the Youngstown Rolling Mill Company and remained with it for 15 years. He overhauled the Warren, Ohio, mills and consolidated the Warren and Girard mills. Mr. Wick retired for a time from active business life, but in 1893 he and other capitalists of Youngstown organized the Ohio Steel Company. Mr. Wick was president, J. G. Butler, Jr., vice-president, William H. Baldwin secretary and Thomas McDonald superintendent. The company built a large Bessemer steel plant at Youngstown, which is now part of the Ohio works of the Carnegie Steel Company. It was the first large steel plant in the Youngstown district. In February, 1899, the Ohio Steel Company was taken over by the National Steel Company, a consolidation of Central Western steel companies, of which Mr. Wick was president for some time and then chairman of the executive committee. When the National Steel Company was taken over by the Carnegie Steel Company after the formation of the United States Steel Corporation in 1901, Mr. Wick retired from the steel business. He was a director of the National Bank and the Dollar Savings & Trust Company of Youngstown, and was a very large owner of realty in that city. He also had holdings in lead, gold and silver mines in Montana, Idaho and British Columbia. He was a member of the Duquesne Club of Pittsburgh, the Union Club of Cleveland and the Suburban Riding and Driving Club of New York. He leaves two sons and a daughter. Mrs. Wick was taken ill of pneumonia last week, after caring for her husband in his illness, and her death came Dec. 28, six days after he had passed away.

SAMUEL DIESCHER, for many years a prominent engineer, died last week at his home in Pittsburgh, aged 76 years. He was born in Budapest and was educated at the University of Karlsruhe. He came to America in 1865, locating in Cincinnati, where he remained until 1870, when he went to Pittsburgh, and for a time was assistant city engineer. He then established a firm of consulting engineers, which he headed until he retired about six months ago. Mr. Diescher constructed many inclined planes and electric lines in the Pittsburgh district and also built a number of steel plants. He was a member of the Engineers' Society of Western Pennsylvania and was at one time its president. He leaves his widow, three sons and three daughters.

CHARLES W. DAVENPORT, vice-president National Foundry Company, Erie, Pa., since its organization in 1899, died suddenly Dec. 21, from dilation of the heart, aged 55 years. He was a native of Erie and a prominent citizen of that city, being a member of various clubs, the Board of Commerce, and the Manufacturers' Association, and was very active in Y. M. C. A. work.

WILFRED R. DEAN, vice-president Dean Bros. Pump Works, Indianapolis, Ind., died recently, after a protracted illness, aged 68 years. He had been a resident of Indianapolis since 1870, in which year his company was established. He retired from active business several years ago.

WILLIAM LAUGHLIN GLESSNER, Wheeling, W. Va., vice-president Whittaker-Glessner Company, and having other important local business connections, died Dec. 21, aged 67 years.

STEPHEN WALKLEY, treasurer Peck, Stow & Wilcox Company from 1875 to 1888, died at his home in Southington, Conn., Dec. 22, aged 83 years. He was the father of Edwin N. Walkley, now treasurer of the company.

JULIUS A. SCHLUETER, president Schlueter Mfg. Company, St. Louis, manufacturer of metal products, died Dec. 25, aged 58 years. He came from Germany at the age of 14. He leaves his widow and five children.

Magnetic Clutch-Brake Used with 650-Hp. Motor

To enable the groups of rubber mills at the Boston Woven Hose & Rubber Company to be driven from a single shaft and yet permit each individual mill to be stopped as often as might be necessary and to start the synchronous motor used for driving this shaft, the Cutler-Hammer Mfg. Company, Milwaukee, Wis., has installed one of its magnetic clutch brakes. The equipment consists of a 650-hp. motor mounted on a common base with a rope sheave, the connection between the sheave and the motor being furnished by the clutch brake. This motor runs at 240 r.p.m., and under normal conditions operates at practically a full load when the mill line is revolving. Safety switches in the mill room stop the mills in case of accident by applying a band brake of locking type, these switches being arranged in series electrically to disengage the clutch and apply the brake simultaneously when a safety bar, one of which is provided for each mill, is tripped. In addition a slack cable switch is installed in the motor room to stop the motor and lineshaft in case the driving rope should break.

To provide for gradual acceleration of the motor a single push button controls the engagement of the clutch, which is energized by an automatic rheostat that is relied upon to cause the load to be picked up gradually and at the same speed for each start. An interesting feature of the electric control system is that if the clutch is disengaged by the stopping button on the motor-control panel the brake is not applied, as is the case where the clutch is disengaged by the opening of a safety switch, and the load is allowed to coast to rest. The quick stop is thus obtained only in case of accident, and while the safety switches can be reset immediately after tripping, power cannot be supplied to the mill line until the single starting button located on the motor-control panel has been operated.

The Effect of Sulphur in Cast Iron

German Experiments Show That It Is
Not Always Harmful—Increased Sul-
phur Content Renders the Iron Stronger

Prof. E. Leber, who succeeded Professor Ledebur at Freiburg, in an article in a recent issue of *Stahl und Eisen* on "Sulphur in Cast Iron," takes exception to the statement that is often made that sulphur makes iron white, hard, brittle and porous, and is in every way harmful in regard to strength. He supports his view by means of results recently obtained on the influence of sulphur on cast iron.

The first results quoted are those of Coe, originally published in the *Journal of the Iron and Steel Institute*, 913, Vol. 1. They are shown in Table 1,

The influence of sulphur is also clearly shown in results obtained with the use of briquetted turnings in the charge. In the original paper a large table is given from which Table 3 is taken. The values given are average results.

This increase in the strength of cast iron with increase in sulphur may also be seen in the latest publications of Jüngst entitled "Contributions to the Investigation of Cast Iron." Although the tests were made for another purpose, they lend themselves well to a study of the influence of sulphur

Table 1—Coe's Results on Influence of Sulphur on Cast Iron Grouped According to Silicon Content

No.	Transverse Strength, Lb. per Sq. In.	Deflec- tion, in.	Tensile Strength, Lb. per Sq. In.	Hard- ness	Graphite	Combined Carbon	Silicon	Sulphur	Man- ganese	Phos- phorus
1.....	18,276	0.100	22,528	58	1.77	1.27	0.80	0.010	0.025	0.01
2.....	.....	.....	18,475	59	0.26	2.80	0.80	0.034	0.025	0.01
3.....	25,573	0.114	.....	60	0.33	2.80	0.78	0.060	0.025	0.01
4.....	28,602	0.120	26,426	58	0.33	2.67	0.82	0.103	0.025	0.01
5.....	16,982	0.100	20,083	47	1.95	1.10	1.31	0.011	0.03	0.01
6.....	23,482	0.116	29,740	50	1.45	1.71	1.35	0.050	0.03	0.01
7.....	30,352	0.126	.....	56	0.80	2.20	1.30	0.105	0.03	0.01
8.....	25,715	0.122	.....	56	0.50	2.44	1.32	0.150	0.03	0.01
9.....	28,830	0.122	29,214	61	0.40	2.51	1.17	0.193	0.03	0.01
10.....	17,195	0.092	22,614	43	2.10	0.92	1.62	0.015	0.04	0.01
11.....	17,408	0.118	35,472	43	2.12	1.00	1.60	0.031	0.04	0.01
12.....	21,818	0.120	31,973	43	1.75	1.05	1.63	0.056	0.04	0.01
13.....	22,187	0.125	.....	40	1.80	1.22	1.40	0.084	0.04	0.01
14.....	20,879	0.126	19,799	43	1.95	1.14	1.57	0.090	0.04	0.01
15.....	19,286	0.135	32,470	49	1.69	1.25	1.52	0.130	0.04	0.01
16.....	20,595	0.100	27,023	60	1.80	1.25	1.69	0.112	0.04	0.01
17.....	22,017	0.090	27,407	60	0.67	2.20	1.55	0.155	0.04	0.01
18.....	14,451	0.080	22,215	45	1.73	1.00	2.24	0.016	0.03	0.01
19.....	20,154	0.114	29,200	45	1.84	1.06	2.24	0.104	0.03	0.01
20.....	25,786	0.150	44,134	43	1.57	1.13	2.37	0.180	0.03	0.01
21.....	19,713	0.097	28,246	53	1.57	1.33	1.23	0.204	0.325	0.01
22.....	20,950	0.124	33,366	44	2.34	0.72	1.05	0.027	0.857	0.01

being grouped according to the silicon percentage; the first with about 0.8 per cent, the second about 1.30 per cent, the third about 1.60 per cent, and the fourth, with the exception of Nos. 21 and 22, about 2.30 per cent. The sulphur of the first group increases from 0.01 to 0.103 per cent, and brings about an increase in the bending test results from 18,276 to 28,602 lb. per sq. in. This is accompanied by an increase in the tensile strength and the deflection. With the second group also the increase in sulphur from 0.011 to 0.193 per cent is accompanied by an increase in the tensile strength and other properties. In the third group also the increase is unmistakable. The size of the transverse test bars was 12 x 1 x 0.6 in.

because in general the same materials were used in the charge, and the charges were melted and cast under the same conditions.

Table 2 is taken from the large amount of material, and is arranged in groups of equal total carbon. In each group the samples are placed according to the sulphur percentage. The increase in transverse strength with increase in sulphur is clearly seen, and in group 3 especially the increase in deflection and shock-test results, the latter being given in meter-kilos per square centimeter.

The increase in tensile and transverse strength cannot be explained by the decrease in carbon and silicon alone. Without doubt the sulphur has had an important part in bringing it about. The lower

Table 2—Jüngst Results on the Effects of Sulphur on Tensile Strength

Group	Heat	Deflec- tion, in.	Transverse, Lb. per Sq. In.	Shock Test*	Graphitic Carbon	Combined Carbon	Silicon	Man- ganese	Phos- phorus	Sulphur
1.....	5	0.354	62,011	0.43	2.55	1.03	1.29	1.10	0.440	0.079
	14	0.335	68,839	...	2.58	0.98	1.42	1.03	0.308	0.103
2.....	5	0.354	61,300	0.35	2.85	0.75	1.34	1.04	0.308	0.062
	5	0.315	60,020	0.36	2.84	0.80	1.42	1.07	0.350	0.087
3.....	7	0.354	59,736	...	2.71	0.97	1.26	1.05	0.364	0.100
	3	0.276	52,340	0.35	2.60	1.12	1.32	1.05	0.332	0.062
	2	0.276	52,482	...	2.67	1.03	1.36	1.01	0.336	0.069
	2	0.354	58,314	0.30	2.78	0.94	1.46	1.01	0.308	0.070
	8	0.315	60,732	0.45	2.73	1.01	1.28	1.01	0.392	0.087
	9	0.394	68,981	0.45	2.69	1.01	1.30	0.82	0.308	0.095
	11	0.394	74,243	...	2.34	0.88	1.30	0.97	0.280	0.100
4.....	3	0.276	58,741	0.37	2.70	1.08	1.32	1.20	0.322	0.060
	13	0.354	66,421	...	2.75	1.03	1.20	0.87	0.364	0.106
5.....	10	0.394	65,567	0.45	2.73	1.15	1.24	0.79	0.364	0.100
6.....	15	0.315	57,175	...	2.81	1.29	1.32	1.00	0.308	0.081
	12	0.315	65,709	...	2.96	1.04	1.13	1.00	0.392	0.112

*Meter-kilos per square centimeter.

Table 3.—Influence of Sulphur When Briquettes Are Used

Series	Briquettes in Charge, Per Cent	Deflection, Inches	Transverse Strength, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Graphitic Carbon	Combined Carbon	Silicon	Man- ganese	Sulphur	Phos- phorus
1	20	0.370	42,242	22,614	3.44	0.25	2.21	0.52	0.094	0.24
	25	0.354	46,793	26,312	2.96	0.59	1.82	0.49	1.13	0.107
	30	0.394	49,638	33,565	3.04	0.45	1.69	0.58	1.10	0.101
3	20	0.453	63,578	33,850	2.42	0.86	1.65	0.66	0.89	0.123
	25	0.374	39,142	23,468	2.63	0.81	2.12	0.68	0.120	0.076
	30	0.551	53,307	24,520	2.55	0.73	2.02	0.70	0.204	0.102
	40	0.591	46,196	30,480	2.54	1.06	2.09	0.68	0.164	0.074
	50	0.559	56,180	34,860	2.53	0.71	1.96	0.65	0.268	0.115
	60	0.347	62,040	36,937	1.78	1.36	1.65	0.56	0.300	0.163
	70	0.540	71,825	38,316	1.85	1.21	1.78	0.59	0.336	0.155
	80	0.236	44,703	tr.	2.74	1.25	1.65	0.65	0.476	0.226
5	30	0.610	37,505	17,664	2.97	0.89	2.08	0.76	0.096	0.080
	40	0.709	51,458	25,573	2.69	0.95	1.84	0.61	0.223	0.110
	50	0.571	37,690	29,299	3.03	0.73	1.92	0.67	0.160	0.105
	60	0.661	68,170	38,971	2.44	0.86	1.69	0.67	0.310	0.195
	70	2.362	66,435	47,547	2.43	0.89	1.48	0.65	0.296	0.191
	80	0.453	64,359	tr.	1.62	1.46	1.34	0.58	0.236	0.204
		0.571	71,939	42,952	2.10	1.00	1.42	0.52	0.308	0.261

the carbon and silicon the greater the influence of the sulphur on the formation of combined carbon; and the lower the total carbon, and higher the combined carbon, the higher the tensile and transverse strength; that is, provided the maximum has not been reached. With what sulphur percentage this maximum is reached depends on the rest of the composition and cannot be definitely given from the results so far obtained. It appears certain, however, that with ordinary machinery castings of normal quality it is not reached with 0.15 per cent.

From the tests it is possible to see that with an iron containing about 3 per cent total carbon, an average silicon of 1.6 per cent, an average manganese of 0.5 per cent, and low phosphorus, the highest allowable sulphur is about 1.6 per cent. It can also be safely said that the iron is more sensitive to the influence of sulphur, the lower the carbon and silicon. The results also show that an increase in sulphur does not increase the brittleness. However, the intentional raising of the sulphur in order to give greater strength is not recommended by Professor Leber, because the inter-relationship of the various factors is not yet well enough understood.

G. B. W.

Consolidation of Foundry Equipment Companies

Announcement is made of the consolidation of the American Foundry Equipment Company and the Sand Mixing Machine Company, with headquarters in the Vanderbilt Concourse Building, 52 Vanderbilt Avenue, New York City, and a branch office in the Columbia Building, Cleveland, Ohio. V. E. Minich, vice-president of the Sand Mixing Machine Company, will have charge of the sales and finances of the consolidated companies, which will, however, continue to operate under their individual names. He will make his headquarters at New York, and H. L. Wadsworth will have charge of production and design, with offices at Cleveland. An automatic sand mixer employed for cutting sand in foundries is built by the Sand Mixing Machine Company. The product of the other company is a complete line of pressure system sand-blast equipment, including an automatic sand-blast tumbling barrel, an automatic rotary table sand-blast room, an automatic sand-blast cabinet and an automatic monorail sand-blast outfit, as well as the designing and building of sand-blast cleaning equipment for special purposes. At the present time it is stated that 225 of the automatic sand mixing machines are in operation in foundries throughout the United States and a double monorail sand-blast plant has been recently installed by the Aluminum Castings Company, Detroit, Mich.

The National Tube Company will exhibit a series of three industrial motion picture films illustrating the manufacture of National pipe from ore to finished product before the students of the Department of Metallurgy, Lehigh University, South Bethlehem, Pa., on Jan. 7 at 11 a. m.

Germany's Accumulated Supply of Ferromanganese

Germany's supplies of ferromanganese have been the subject of considerable speculation as the war has progressed. It is known that there are no mines of consequence in that country producing high grade ore suitable for conversion into ferromanganese. The German steel industry, like that in the United States, has always been dependent on its imports of Indian, Russian or Brazilian ores. The output of native manganese iron ores suitable for conversion into spiegeleisen are ample. But about 41 per cent of Germany's steel output requires the use of ferromanganese, the other 59 per cent being Bessemer steel, for which spiegeleisen is entirely suitable.

A French authority, the Comité Central des Houillères de France, has recently published data on the great trade movements which have taken place in Germany in recent years, showing that Germany's importations of manganese ore in the five years from 1909 to 1913 inclusive amounted to 2,469,522 metric tons, of which 35,839 tons was exported, leaving 2,460,683 tons for use in that country. The following table of imports of manganese ore from the source mentioned and of the non-Bessemer steel output, based on a study of German statistics, has been compiled:

Year	Manganese Ore Imports, Metric Tons	Non-Bessemer Steel Output, Metric Tons
1909	384,445	4,381,235
1910	487,872	5,496,959
1911	420,709	6,191,810
1912	523,125	7,320,519
1913	680,371	8,173,984
Total	2,496,522	31,564,507
Exported	35,839	
Available	2,460,683	

Russia and India supplied 82.1 per cent of these imports in 1909, 83.2 per cent in 1910, 83.2 per cent in 1911, 86.6 per cent in 1912, and 91.27 per cent in 1913.

It is estimated that the production of ferromanganese, based on a comparison of ore imports and ferromanganese production over a long period, is equal to 40 per cent of the weight of ore. It is also a fair assumption that the average consumption of ferromanganese is about 17 lb. per ton of steel. Using these assumptions and the data from the foregoing table we have the following:

	Ferromanganese, Metric Tons
2,460,683 tons of manganese ore will produce about	984,273
31,564,507 tons of steel require about	243,464
Excess over consumption in 5 years	740,809

It is therefore evident that Germany's supplies of ferromanganese or of ore available for conversion into it are ample even with no imports during the war. Considering these calculations and assumptions to be at least approximately true, Germany has still over three years' supply of ferromanganese or ore from which to make it, if the steel output is normal.

An Alloy Steel of Special Composition*

High Grade Castings and Forgings of a Manganese-Copper-Nickel Steel Showing Superior Static Properties and Developed at a Low Cost—Effect of Chromium

BY J. B. RHODES

It is the purpose of this paper to describe the qualities of an alloy steel which has been found to furnish high grade castings and forgings from the same mix and at comparatively low cost. The principles involved are comparatively well known and no originality is claimed, but it is believed that the alloy described (and its complement) is being regularly manufactured for use for the first time.

In order to increase the output of a small open-hearth furnace it was desired to manufacture ingots for forging purposes without abnormally increasing the cost of castings. These ingots were to be used for forgings which are required to show minimum physical values in a transverse direction, as follows:

Tensile strength, 95,000 lb. per sq. in.
Proportional limit, 65,000 lb. per sq. in.
Elongation, 18 per cent.
Reduction of area, 30 per cent.

It was believed that the steel as cast would, if capable of showing the above values in forgings, give in properly annealed castings the following physical values:

Tensile strength, 85,000 lb. per sq. in.
Yield point, 53,000 lb. per sq. in.
Elongation, 22 per cent.
Reduction of area, 35 per cent.
Bend, 120 deg. around 1-in. diameter.

Carbon which increases both strength and hardness, but which should not be present in larger amount than 0.60 per cent.

Manganese, which increases the strength and hardness and acts as a deoxidizer, but which should not be present in larger amounts than 2 per cent.

Nickel, which increases strength and toughness, but which should not be present in larger amounts than 5 per cent.

Copper, which has an effect similar to that of nickel, but should not exceed 4 per cent.

Chromium, which hardens the metal, increases its susceptibility to heat treatment, but which should not exceed 3 per cent.

Consideration of the above shows the possibility of obtaining steel of the grade desired by adding copper and manganese to the usual nickel-steel alloy. Steel containing more of the hardening agents than shown above are liable to be brittle and treacherous; in fact, the amounts given above are considered rather high. Of these alloying agents carbon and manganese are the most easily obtained and the least costly. It was decided to limit the carbon to 0.35 per cent and the manganese to 1.20 per cent, or about 0.60 per cent higher than normal. It was found that nickel could be obtained in turnings from 3 per cent nickel-steel in sufficient quantity to give 1 per cent to 1.5 per cent in the steel, and nickel with copper could be obtained in the form of monel-metal scrap and turnings containing

Table 1—Physical Tests from Coupons Cast on Body of Castings

Heat	Carbon, Per Cent	Sulphur, Per Cent	Man- ganese, Per Cent	Silicon, Per Cent	Phos- phorus, Per Cent	Nickel, Per Cent	Copper, Per Cent	Tensile Strength, Lb. per Sq. In.	Yield Point, Lb. per Sq. In.	Elong- ation, Per Cent	Reduc- tion of Area, Per Cent	Bend, Degrees
201	0.36	0.036	0.81	0.31	0.034	1.60	0.76	92,283	55,767	22	37	120
204	0.30	0.037	0.93	0.36	0.04	1.44	0.85	92,334	55,003	21	31	120
207	0.33	0.030	1.02	0.38	0.035	1.15	0.49	88,616	54,494	25	40	120
208	0.34	0.034	1.04	0.36	0.033	1.14	0.52	92,691	56,277	22	34	120
214	0.35	0.035	1.11	0.33	0.042	1.34	0.60	95,543	59,078	22	37	120
215	0.30	0.032	0.93	0.35	0.043	1.12	0.77	90,042	57,550	23	37	120
216	0.27	0.04	1.18	0.35	0.046	1.60	0.61	92,691	55,003	22	36	120
218	0.34	0.042	1.15	0.35	0.035	1.58	0.69	94,830	54,748	22	36	120
219	0.27	0.035	1.02	0.30	0.047	1.47	0.42	85,510	56,022	23	34	120
223	0.38	0.029	1.02	0.35	0.049	1.10	0.80	88,718	55,512	23	38	120
228	0.30	0.031	1.15	0.38	0.046	1.60	0.56	96,510	59,587	23	37	120
230	0.36	0.036	1.18	0.31	0.049	1.37	0.80	94,117	50,929	23	36	120
232	0.36	0.036	1.03	0.35	0.039	1.47	0.63	90,144	55,225	23	34	120
233	0.36	0.035	1.03	0.40	0.04	1.73	0.21	96,052	59,087	25	41	120
234	0.32	0.036	1.21	0.36	0.049	1.24	0.65	91,366	55,003	25	44	120
236	0.31	0.032	1.15	0.34	0.043	1.54	0.70	81,343	60,096	25	41	120
241	0.31	0.033	0.96	0.39	0.042	1.27	0.64	87,343	53,457	23	36	120
245	0.31	0.032	1.15	0.37	0.037	1.80	0.62	92,181	55,288	23	36	120
248	0.33	0.032	0.79	0.42	0.048	1.69	0.65	87,191	54,239	23	38	120

In going over the ground of previous experimenters the following points were determined:

In order to obtain a steel of high physical properties with considerable ductility and machinability it is necessary to produce a pearlitic steel. High grade steels are amorphous to a great degree and are fine grained. The microscope should show a uniform mixture of constituents. Although it is generally considered that true pearlitic is a eutectic of cementite and ferrite, it is known that a pearlitic structure is obtained in alloy steels in which the amount of pearlite is in excess of that due to carbon alone.

Knowing that brittle ranges are found where carbon, nickel, chromium, manganese, etc., are present in the percentages necessary to give true eutectics, and knowing the superiority of ternary and quaternary steels, i.e., steels containing chromium and nickel and those containing chromium, nickel and vanadium in addition to the carbon, it was decided to limit the percentage of each hardening or toughening element and to increase the pearlite by the use of additional elements. The following were considered:

*Journal of the American Society of Naval Engineers. The author is a lieutenant in the United States Navy.

Table 2—Physical Tests of Bars Cut from Body of Forgings—Transverse

(Steel of same heats shown in other table)

Heat No.	Tensile Strength, Lb. per Sq. In.	Limit of Propor- tionality, Lb. per Sq. In.	Elongation, Per Cent	Reduction of Area, Per Cent
A-410-6	102,469	72,421	21.65	37.6
	98,853	64,272	23.80	47.3
A-410-9	99,719	63,254	21.85	42.2
	97,529	63,254	26.45	52.4
A-410-10	100,585	68,347	17.35	30.78
	97,529	63,254	26.45	52.4
A-408-1	110,516	77,412	21.6	45.2
A-408-2	113,164	80,570	18.9	34.08
A-408-3	110,923	77,514	23.5	51.3
4 X 1	117,952	85,561	22.3	51.0
4 X 2	119,836	89,890	20.2	49.6

Physical Tests of Bars Cut from Body of Forgings—Longitudinal

A-779-1	105,423	72,319	24.8	56.4
A-779-4	95,135	67,226	28.7	65.7

approximately 65 per cent. nickel and 30 per cent copper.

The increase in manganese by 0.6 per cent or 6 lb. per 1000 can be made by adding not more than 10 lb. per 1000 of manganese, which in the form of 80 per cent ferromanganese, costs about 6c. per lb. for man-

ganese, an increase of 60c. per 1000 lb., or 0.006c. per lb. Nickel-steel turnings are worth about \$10 a ton more than ordinary scrap (as based on sale of own scrap), which means that nickel in this form is obtained for 5c. per lb. instead of 35c. or 40c. per lb. To obtain 1 per cent to 1.5 per cent nickel 15 lb. per ton are added, at a cost of 75c. per 1000 lb., or .00075c. per lb. To obtain 0.50 to 0.75 copper, monel-metal scrap at 12c. per lb. is added. Two per cent of monel metal gives 0.70 copper and 1.20 nickel, at a cost of \$2.04 per 1000 lb., or .0024c. per lb. The cost of these additions are as follows:

Manganese	\$0.0006
Nickel	0.00075
Monel	0.0024
Total	\$0.00375

So that for an increase of less than \$0.004 per lb. we obtain a steel equal in properties to a 3 per cent nickel-steel.

The composition of the steel may be taken to be as follows:

	Per Cent
Carbon	0.30 to 0.35
Silicon	0.25 to 0.35
Phosphorus and sulphur	Not over 0.05
Manganese	1.00 to 1.20
Nickel	1.50 to 1.80
Copper	0.50 to 0.80

This steel will show properties equal to those specified. Tables 1 and 2 show some physical tests and analyses of castings and forgings.

The addition of chromium in sufficient quantity to give 0.50 per cent chromium in the alloy increases the physical properties to those of ordinary chrome-nickel steel containing 1 per cent chromium and 3 per cent nickel. Table 3 shows the properties of such an alloy.

Table 3—Physical Tests of Forgings of Same Composition Carrying About 0.50 Per Cent Chromium

Heat No.	Tensile Strength, Lb. per Sq. In.	Limit of Proportionality, Lb. per Sq. In.	Elongation, Per Cent	Reduction of Area, Per Cent
A-749	130,379	117,608	19.0	47.6 Long.
6 X 1-1	141,940	107,050	16.0	42.0 Trans.
	146,417	113,739	15.2	45.0 Trans.
6 X 1-2	156,329	117,429	15.5	42.5 Trans.
	147,695	108,021	15.1	42.2 Trans.
6 X 3	126,151	106,543	16.6	40.0 Trans.
6 X 4	130,328	106,441	17.7	43.0 Trans.
6 X 5	130,226	110,516	19.6	48.5 Trans.

It is believed that the excess manganese prevents red shortness due to copper oxide by combining with any oxygen present in the bath. Castings are remarkably free from checks, cracks, blowholes and shrinks, and ingots are normal.

Bonuses to Employees

The Scovill Mfg. Company, Waterbury, Conn., maker of brass goods, announced Dec. 16 the payment of a 10 per cent bonus, based on annual salary, to all its salaried employees. Some time ago the company increased the wages of its employees on piece work and day wages 10 per cent.

At Athol, Mass., Dec. 24, a gift to the 1000 employees of the L. S. Starrett Company, tool manufacturer, of a sum equal to 2 per cent of a year's wages, was announced.

The Graton & Knight Mfg. Company, belt manufacturer, Worcester, Mass., Dec. 24, distributed \$85,000 among its 1700 employees as bonuses for loyalty during the last year in an unprecedented rush of business.

The Worcester Pressed Steel Company, Worcester, Dec. 24, distributed \$10,600 among its 300 employees.

The Wyman & Gordon Company, Worcester, Dec. 24, gave its 451 employees \$11,600. The oldest employee, with a record of 27 years, received \$145.

The Potter & Johnson Machine Company, Pawtucket, R. I., announced a further increase of pay of 5 per cent. It had previously, in August, given an increase of 5 per cent.

The Union Mfg. Company, New Britain, Conn., has announced that each of its 400 employees will receive a substantial share of the company's profits as soon as the year's results can be figured.

ASSOCIATE MEMBERS PRO TEM.

Recent Additions to the American Iron and Steel Institute List

The directors of the American Iron and Steel Institute at their meeting in New York on Dec. 10 elected the following persons to membership:

ACTIVE MEMBERS

- William P. Barba, vice-president Midvale Steel Company, Philadelphia.
- Julian Burdick, secretary-treasurer and general manager of sales, West Penn Steel Company, Brackenridge, Pa.
- Herman M. Hurd, treasurer Republic Iron & Steel Company, Youngstown, Ohio
- James Clare Miller, secretary-treasurer Columbus Iron & Steel Company, Columbus, Ohio
- Howell C. Rockhill, vice-president Fort Wayne Rolling Mill Corporation, Fort Wayne, Ind.

ASSOCIATE MEMBERS

- *Louis S. Baldwin, superintendent Struthers Furnace Company, Struthers, Ohio
- *William Henry Bennett, superintendent bar mills, Carnegie Steel Company, Clairton, Pa.
- *Duke N. A. Blacet, metallurgical engineer Central Steel Company, Massillon, Ohio
- *George J. Bryen, master mechanic Carnegie Steel Company, Duquesne, Pa.
- *Morrow Chamberlain, secretary-treasurer Roane Iron Company, Chattanooga, Tenn.
- *Samuel Edwin Eldridge, engineer Columbus Iron & Steel Company, Columbus, Ohio.
- *Herbert L. Hart, manager bolt and rivet department Inland Steel Company, Chicago.
- Jaquelin S. Holliday, vice-president W. J. Holliday & Co., Indianapolis, Ind.
- *Horace E. Horton, agronomist American Steel & Wire Company, Chicago.
- *John E. Jones, general manager Globe Iron Company, Jackson, Ohio.
- John M. Keller, chief engineer National Carbon Company, New York.
- Edward J. Lavino, Philadelphia.
- John Edmund McCauley assistant general manager Birdsboro Steel Foundry & Machine Company, Birdsboro, Pa.
- *Sidney Morrill McCurdy, physician and surgeon Youngstown Sheet & Tube Company, Youngstown, Ohio.
- Edward G. Miner, president Pfaudler Company, Rochester, N. Y.
- *James L. O'Neill, credit manager Carnegie Steel Company, Pittsburgh.
- William Rattle, chemist, Cleveland, Ohio.
- *Walter C. Runyon, Jr., assistant to president Struthers Furnace Company, Cleveland, Ohio.
- *Luciano Selmi, chief chemist Corrigan-McKinney steel plant, Cleveland, Ohio.
- Alvan Tracy Simonds, president Simonds Mfg. Company, Fitchburg, Mass.
- Frederick L. Sivyver, president Northwestern Malleable Iron Company, Milwaukee, Wis.
- Oberlin Smith, president Ferracute Machine Company, Bridgeton, N. J.
- *William B. Trainer, superintendent rolling mills, Carnegie Steel Company, Duquesne, Pa.
- Alexander T. Whiting, secretary Whiting Foundry Equipment Company, Harvey, Ill.
- *Howard Wood, Jr., assistant secretary and assistant treasurer Alan Wood Iron & Steel Company, Philadelphia.
- *Samuel G. Worton, superintendent open hearth department Carnegie Steel Company, Duquesne, Pa.
- *Stanley Edward Elkin, general manager Maritime Nail Company, Ltd., St. John, N. B.
- John Glass, manager Chicago office Manufacturers' Record Publishing Company, Chicago.
- Frank Gould, vice-president Manufacturers' Record Publishing Company, Baltimore.
- *Edward Everett Hughes, general manager Franklin Steel Works, Franklin, Pa.

*Indicates those placed temporarily on associate list, to be transferred to active list as vacancies occur.

The North Wales Machine Company, North Wales, Pa., manufacturing wheel-grinding machinery, power geared hack saw machines, sensitive drill presses and other machine tools, also operating a gray-iron foundry, is building an addition to its plant, to be 60 x 160 ft.

Machinery Markets and News of the Works

EXPORT SHIPMENTS HALTED

Railroad Freight Jam Gives Trouble

Holiday Causes Slight Interruption to Business and Demand Continues Strong—New England Prosperous Despite Strikes

The activity of the last week of the year is maintained at the pace of the past few months. In export shipping the machinery trade faces a most serious situation. Heretofore, a great deal of distress has been caused by the lack of ocean freight space, to which is now added trouble in getting shipments to the seaboard. Domestic as well as foreign buyers are affected by the bad railroad situation. In Cleveland some of the manufacturers are notifying buyers that if shipments are made they must assume all liability for demurrage charges. Business was but slightly halted by the Christmas holiday.

The demand in Cleveland for automatic screw machines is about as heavy as for any kind of tools in the last few months. In that city a good part of the inquiry is for small lots. Cincinnati business men are much interested in the trade opportunities presented in Russia, and are taking steps to secure reliable representatives in that country. Local jobbing foundries in Cincinnati are not as busy as they were sixty days ago, but are ahead of this time in 1914.

Though some parts of New England are still engrossed with strike troubles, that section of the country is having an unexampled period of prosperity. The Maxim Munitions Company has found it unnecessary, at present, to erect a building at New Haven as planned, owing to its having obtained sufficient space by the purchase of the Secor Company, Derby, Conn.

The Weimer Machine Works Company, Lebanon, Pa., has let a contract for a machine shop 70 x 212 ft., to replace one destroyed by fire. The company builds coke and furnace charging barrows, etc. The Harlan & Hollingsworth Corporation, Wilmington, Del., plans to erect additional shops, but not much machinery will be required. The Comas Cigarette Machine Company, Salen, Va., will erect a machine shop 120 x 140 ft. The Traylor Engineering & Mfg. Company, Allentown, Pa., has prepared plans for extensive additions to its works.

The Briscoe Motor Company, Jackson, Mich., has been reorganized and has acquired the business and plant of the Mason Motor Car Company, Waterloo, Iowa, and two other plants. The Gier & Dail Mfg. Company, Lansing, Mich., plans to install equipment for the manufacture of light and heavy stampings, pressed steel parts, etc.

Shipments from Milwaukee are proceeding at a good rate despite the congestion of freight in the East. The Gillette Safety Tire Company, Grand Rapids, Mich., which is building a plant at Eau Claire, Wis., has contracted for the equipment needed with the Adamson Machinery Company, Akron, Ohio.

St. Louis continues to find second-hand machinery

difficult to obtain. A machine shop is to be equipped at Monroe, La., by the St. Louis, Iron Mountain & Southern Railroad.

The Winton Engine Works, Cleveland, Ohio, builder of marine motors, has started an addition to its plant, 50 x 350 ft., designed to double its capacity. The Hercules Motor Mfg. Company, Canton, Ohio, recently organized, has placed the contract for the first unit of its plant. The building will be two stories, 65 x 400 ft.; of reinforced concrete. The Tilotson Mfg. Company, Toledo, Ohio, manufacturer of carburetors, has leased a building which will enable it to double its present output.

An inquiry is pending from Ottawa, Ont., for about sixty turret lathes for machining shrapnel time fuses. The machines must be delivered in time to permit the starting of the fuse contract in about sixty days.

New York

NEW YORK, Dec. 29, 1915.

Demand has not slowed up with the mid-winter holiday as it does in normal years, and the last week of the year promises to be as busy as those which preceded it. Export shipments are being made with the greatest difficulty, not only because of the lack of ocean freight space, but because of the congestion of freight on the railroads, as a result of which many lines have declared embargoes on all but perishable freight and coal.

The General Electric Company has made inquiry for a list of eight machines, all turret lathes. The Bijur Motor Lighting Company has continued to purchase.

Samuel L. Moore & Sons, Elizabethport, N. J., a subsidiary of the Bethlehem Steel Company, have had plans drawn for a three-story brick machine-shop, 160 x 250 ft. Cleaves & Graham, Elizabethport, the architects, have been taking bids recently.

The John W. Ferguson Company, United Bank Building, Paterson, N. J., has received the general contract to erect a two-story factory 100 x 185 ft., for the Ward-Leonard Electric Company, Bronxville, N. Y., at a cost of about \$35,000.

The Turner Construction Company, 11 Broadway, New York City, has been awarded the contract for the construction of sections E and F for the terminal development of the Hoboken Land & Improvement Company, Hoboken, N. J. These buildings will be 81 by 496 ft., with wing 27 by 80 ft., twelve stories and basement, of reinforced concrete. Work will be undertaken at once. Charles Fall, 1400 Washington Avenue, Hoboken, is the architect.

Philadelphia

PHILADELPHIA, Pa., Dec. 27, 1915.

The Weimer Machine Works Company, Lebanon, Pa., manufacturer of coke and furnace-charging barrows, etc., has let contract to the McClintic-Marshall Company, Pittsburgh, for the construction of a machine shop, 70 x 212 ft., to replace its plant which was destroyed by fire. The Niles-Bement-Pond Company will install a 25-ton electric crane. A local company will be selected to erect a pattern shop, 40 x 140 ft. It is planned to have the plant in operation by April 1.

The Philadelphia Steel & Forge Company, Milnor and Bleigh streets, Philadelphia, has awarded contract to the Belmont Iron Works, Twenty-second Street and Washington Avenue, for a steel and brick shop, 50 x 108 ft., to cost several thousand dollars.

The Miller Lock Company, 4523 Tacony Street, Philadelphia, has taken out a permit for a one-story addition to its machine shop, 100 x 195 ft., to cost \$25,000, and a two and one-half-story warehouse, 75 x 250 ft.

The O'Meara Construction Company is to build a two-story addition, 34 x 50 ft., to the boilerhouse of the Pennsylvania Sugar Company, 1039 North Delaware Avenue, Philadelphia, at a cost of \$40,000.

Burt Brothers, furniture manufacturers, 2000 South Ninth Street, Philadelphia, Pa., plan the construction of an additional third and fourth stories, 24 x 70 ft., to cost about \$4,000. No machinery is needed.

The Traylor Engineering & Mfg. Company, Allentown, Pa., is planning to construct two new buildings within the next six months. About 400 men will be added to the present force of 1200. One of the buildings will be erected due west of the present shops and will be 150 x 400 ft., of steel and brick construction. It will be used to manufacture ordnance. A balcony will be erected on both sides of the shop and here the lighter machinery will be installed. Another building will be a four-story warehouse, to be erected in front of the present plant. It will be of reinforced concrete, 100 x 200 ft., four stories. The railroad tracks will be moved to the bank of the Little Lehigh River. Other improvements are also contemplated. Some machinery has already been ordered. It is expected that the buildings will be ready next June.

Henry Disston & Sons, Inc., Tacony, Philadelphia, has awarded contract to F. W. Van Loon, Denckla Building, Philadelphia, for the construction of an annealing and pickling building, 50 x 366 ft.; forge shop, 50 x 360 ft., etc.

The Tioga Machine Company, 2027 Estaugh Street, Philadelphia, has awarded contract to Burd P. Evans & Co., Thirteenth and Wallace streets, for the construction of a machine shop and offices, of brick, one story, 105 x 116 x 157 ft., to be erected at Twenty-third and Ontario streets, Philadelphia, at a cost of \$6,800.

The Pennsylvania Equipment Company, Coleman Building, Philadelphia, is in the market for a shear for cutting sheet bars or skelp; maximum width, 12 in.; thickness, 1 in. Shearing will be done cold. A 19-in. blade will be adequate.

New England

BOSTON, MASS., Dec. 27, 1915.

The strike situation in New England did not materially change this past week. The strike at the New England Westinghouse Company, Chicopee Falls, Mass., has been confined almost wholly to the toolmakers at the River plant and both sides are apparently marking time until the public hearing, ordered by the State Board of Conciliation and Arbitration, to be held Dec. 29. The union officials have announced that they will make it clear to the State Board that they are not seeking to make the shops "closed shops" but are only aiming to get equal representation on the shop committees.

In the press of the manufacturing cities of New England are beginning to appear numerous reviews of the year industrially and all agree that this section is experiencing a period of prosperity almost beyond precedent. The point brought out is the very real prosperity characterizing those industries which, because of the character of their products, have no opportunity to participate in the direct war business. Another feature is the large number of long-idle plants which are being reopened.

The Simplex Wire & Cable Company, Cambridge, Mass., has taken out a permit for the erection of another factory building.

The Converse Rubber Company, Malden, Mass., has started work on an addition to its boilerhouse and the construction of a drying bridge.

The recently reported increase in capital stock authorized by the Fafnir Bearing Company, New Britain, Conn., is to cover another large factory addition and increase in machine equipment which will practically double its present production. It is hoped that the addition will be available for manufacturing Feb. 1, as the building contract has already been awarded and construction is now under way.

The West Boylston Company, Easthampton, Mass., according to a press report, is contemplating the erection of another large mill, 120 x 600 ft., three stories.

The Stafford Worsted Company, Stafford Springs, Conn., has been organized with capital of \$150,000. Building operations will commence in the spring and the new plant will be ready for business by July. The plant will consist of a main mill, 115 x 200 ft., two stories, with power house and office building separate. William Park is president and Walter Scott, general manager.

C. J. Bates & Son, Chester, Conn., are to erect a building, 40 x 80 ft., two stories, and a boilerhouse, 30 x 40 ft.

The Hopkins & Allen Arms Company, Norwich, Conn., has bought a large tract of land on Franklin Street.

The Maxim Munitions Company, New Haven, Conn., will not erect the buildings contemplated as an addition to the

Fuller plant at New Haven, as the purchase of the plant of the Secor Company at Derby has made it unnecessary. The Secor plant may be enlarged later on. The Seward plant at New Haven, which the company recently bought, will be continued as a drop forging plant.

The Stephens Nut & Bolt Company, Pawtucket, R. I., manufacturer of nuts, bolts, coach screws and metal stamping and drawing, has located a plant at 755 High Street, Central Falls, R. I., which it has placed in full operation and is gradually increasing its output. Jacob Stephens, for sixteen years general manager of the William H. Haskell Company, is president, and Albert C. Stephens is secretary and treasurer. He was for three years superintendent of the Haskell Company.

Baltimore

BALTIMORE, MD., Dec. 27, 1915.

Improvements to cost about \$42,000 are to be made at the plant of Harlan & Hollingsworth Corporation, Wilmington, Del. Two buildings, 43 x 163 ft., will be erected for use as paint, rigging and carpenter shops and a plate room. A crane foundation also will be constructed.

Two one-story additions will be constructed at the shipyard of John S. Beacham & Brother, Covington Street, Baltimore.

A contract for a workshop and supply department, 18 x 90 ft., for the Richmond & Rappahannock River Railway, Richmond, Va., has been awarded the John T. Wilson Company, Richmond.

Prices on electrical machinery are being sought by the City Point Ice Corporation, Alexandria, Va.

The capital stock of the Virginia Can Company, Buchanan, Va., has been increased from \$300,000 to \$450,000.

Chicago

CHICAGO, ILL., Dec. 29, 1915.—(By Telegraph).

Inquiry for machine tools has quieted, with the holiday season at hand and the inventory period approaching, nor has there appeared any important new inquiry in connection with war manufactures. The effect of railroad congestion upon shipments from Chicago has been more noticeable in the movement of tools from stock, and in a number of instances machines crated for shipment are being held here. The Michigan Central Railroad still appears to be handling consignments without difficulty from that market. Activity in the buying of second-hand machinery is unabated.

Cleveland

CLEVELAND, OHIO, Dec. 27, 1915.

Delays in machine-tool shipments for export, owing to freight congestion at the Atlantic seaports, are the cause of much inconvenience to machinery builders, and some are notifying buyers that if shipments are made they must assume all liability for demurrage charges. Little falling off in the volume of business has been caused by the holiday season. The demand for automatic screw machines is about as heavy as at any time for the past few months. While large inquiries are lacking, the volume is made up in small-lot inquiries. Orders are being taken for delivery in about six months. The demand for turret lathes has eased off somewhat. Business with machinery houses continues good. Orders for the most part are for single tools or small lots of machinery.

The Allyne-Ryan Foundry Company, Cleveland, Ohio, has started on additions to its plant. These will include an extension to the foundry, 80 x 150 ft., and another to the cleaning room 40 x 50 ft. A battery of nine additional tumbling mills for cleaning cylinders and an additional core oven are being installed. An electric trolley system for conveying the metal will also be put in.

The Winton Engine Works, Cleveland, Ohio, builder of marine motors, has started the erection of an addition to its plant, 50 x 350 ft., which will about double its present capacity.

The Electric Auto-Lite Company, Toledo, Ohio, has commenced the erection of a four-story factory addition, 105 x 380 ft.

The Tillotson Mfg. Company, Toledo, Ohio, maker of carburetors, has leased a three-story building on Jackson Street, formerly occupied by the Meilink Mfg. Company. This will give the company double its former capacity.

The Orcutt Pipe Hanger Company, Toledo, Ohio, has been incorporated with a capital stock of \$15,000 by Fordyce J. Orcutt and others, and has established a plant in the Toledo Factories Buildings.

ANNUAL REVIEW NUMBER

THE IRON AGE of January 6, 1916, following a custom long honored, will accompany its annual review of Iron, Steel and Machinery Trade conditions with an unusual array of feature articles.

**What has this year of world war taught
American manufacturers in these great industries?**

What after the war?

Around these two questions some of the important discussions of this monumental issue revolve.

Prominent manufacturers have given their reading of the signs for 1916 for the benefit of IRON AGE readers.

Leaders in the machine tool trade in another section of the paper take a forward look, pointing out probable conditions in that industry when peace is declared.

¶ A suggestive article by C. A. Tupper deals with the "Effects of War Work on American Shops." The author brings out some permanent results of munitions manufacture that have not been generally talked about.

¶ Sterling H. Bunnell writes interestingly from the standpoint of a manufacturer who has had to find his way through the problems of shell work.

¶ A steel works housing system with striking features is well illustrated, and a phase of welfare work at the Duquesne Steel works is presented pictorially.

¶ A modern blast furnace gas cleaning plant and a leading steel rolling mill are described and illustrated.

¶ In the "described and illustrated" class also is the story of a forging plant in which construction and equipment represent the latest thought in that quarter. Forging manufacture has had a pivotal place in metal-

working since European shells have stood so high in the "Made-in-America" list. An illuminating foundry article gives details of machine molding of light castings and of the pouring operations.

¶ How steel making problems of 1915 were met by operating men—for example, meeting the war's demand and increasing output when supplies of alloying metals were cut down much below normal. Commercial problems were so dominant that metallurgical progress was not as great in 1915 as in other recent years—one of the points made by J. E. Johnson, Jr., in his review of iron and steel works developments in the past year.

¶ *What the War Has Taught Military Experts*—In a noteworthy article dealing with ordnance in army, navy and coast defense, Lieut. Logan Cresap, U. S. N., discusses some of the war's lessons from a military standpoint.

HIGH MARK IN SERVICE

The present issue of THE IRON AGE closes a year of most extraordinary transition from depression to high level consumption and prices. The problems such a year brings to a trade journal like THE IRON AGE are neither small nor few. However, in none of the sixty years since this paper was founded has its influence been so far-reaching, the number of its readers and advertisers so large, or its capacity to serve its constituency so great.

Our Annual Review Number of January 6, to which this page is an index finger, begins a year in which, the editors feel safe in saying, THE IRON AGE will take a higher place than in any of the sixty years that have gone before.

Milwaukee

MILWAUKEE, WIS., Dec. 27, 1915.

By reason of unfilled orders now on their books machine-tool builders in the Milwaukee district are assured of a necessity to maintain present extended schedules of operations throughout the greater part of the coming year. Deliveries are being made at the usual rate, in spite of the congestion of shipments at the Atlantic seaboard. Milwaukee tool builders are concerned mainly with the production according to specifications rather than the actual delivery to purchasers, leaving it to the dealers to arrange for the placing of goods with buyers whom they represent.

The present season has been one of liberal profit-sharing with employees. In some instances, reductions in wages due to general business depression have been returned in full as a Christmas gift. The feeling compared with that a year ago is vastly better in every way. Employers who have shared in the prosperity resulting from contracts for munitions of war declare that with few exceptions have they ever known a condition which brought so large a margin as present business.

The Wisconsin Iron & Wire Works, 186 East Water Street, Milwaukee, has increased its capital stock from \$30,000 to \$80,000 to accommodate its growing business.

The Gillette Safety Tire Company, Grand Rapids, Mich., which is building the first unit of its permanent plant at Eau Claire, Wis., has contracted with the Adamson Machinery Company, Akron, Ohio, for the entire equipment. The contract is said to be worth \$30,000.

The W. A. Roosevelt Company, Front and Vine streets, LaCrosse, Wis., manufacturer of plumbers' and steamfitters' supplies, is arranging to build a new office and warehouse, five stories, 70 x 100 ft., to cost \$60,000. Parkinson & Dockendorff, LaCrosse, are the architects.

Martin Tullgren & Sons, architects, 133 Second Street, Milwaukee, are in charge of plans for the erection of a garage and machine shop at Downer Avenue and Webster Place, Milwaukee. It will be 122 x 170 ft., two and three stories and basement. The name of the owner and occupant is withheld.

A high school, 84 x 150 ft., costing \$50,000 and including a manual training department as a feature will be built by the city of Bangor, Wis., in 1916. Plans are being prepared by Parkinson & Dockendorff, architects, LaCrosse, Wis.

The Felker Bros. Mfg. Company, Marshfield, Wis., has awarded the general contract for the erection of a factory to replace its plant destroyed by fire recently, to Krasin Brothers, Marshfield. The new plant will be 75 x 130 ft., of brick and steel, and equipped for the manufacture of steel culverts, well casings, silo fillers, etc. A. G. Felker is president.

The Wisconsin Valley Electric Company, Appleton, Wis., has increased its capital stock from \$400,000 to \$800,000 to provide for extensions to its facilities.

The Oestreich Foundry & Machine Company, Milwaukee and Mill streets, Plymouth, Wis., has leased its buildings to M. P. Roebke, who will operate a general machinery and repair business.

The Sieverkropp Engine Company, Racine, Wis., manufacturer of automobile accessories, which is erecting a machine shop, 50 x 100 ft., on DeKoven Avenue, will add seventy-five to a hundred operatives.

Herman J. Esser, architect, 402 Camp Building, Milwaukee, will close bids Jan. 4 for the plant of the Fitzsimmons Steel Products Company, Milwaukee, including the power plant, 30 x 45 ft., containing two 150-hp. boilers.

The Phoenix Mfg. Company, Eau Claire, Wis., maker of sawmill machinery and equipment, is devoting practically its entire facilities to the manufacture of Conradsen engine lathes. The works are operating 23 hr. a day. The company recently brought out a new type of tool post for lathes, and is filling large orders for this device. President C. L. Tolles declares no war munitions are being made in the plant.

Cincinnati

CINCINNATI, OHIO, Dec. 27, 1915.

Domestic inquiry for machine tools has fallen off, due to the holiday season. Considerable business from abroad is still in sight, and local manufacturers are very much interested in the Russian field. In spite of difficulties in transportation quite a lot of machinery is being shipped to Russia from this territory. Manufacturers are also making efforts to obtain reliable representatives in that country, as they believe it will be a more profitable field after the war has ended. The demand for portable electric drilling machines continues unabated, and all local makers of these tools are busy.

Efforts to end the labor troubles at Hamilton, Ohio, have not been without good results. Quite a number of men are returning to work in different shops, as better police protection is now afforded them. In Cincinnati the situation is practically unchanged.

The local jobbing foundries are not quite as active as they were sixty days ago, but the record is far ahead of the corresponding month in 1914.

The G. A. Schacht Motor Truck Company, Cincinnati, is moving its plant from Spring Grove Avenue to the manufacturing building at Gest and Evans streets. It will increase its manufacturing facilities.

The Fahrenstock Mfg. Company, Union Bank Building, Pittsburgh, Pa., is reported to be negotiating a deal for locating a steel foundry in Cincinnati. The company, which is headed by practical foundrymen, controls patents on a special molding machine.

The Queen City Bottling Works, Cincinnati, will make an addition to its plant, 50 x 100 ft., two stories, of mill construction. Only special equipment will be required.

The Talbert-Zoller Lumber & Veneer Company, Winton Place, Cincinnati, will soon double the capacity of its plant.

It is currently reported that the Mal-Gra Castings Company, Cincinnati, recently incorporated, will operate a plant in Cambridge City, Ind. Thomas P. Greenhow, Hamilton, Ohio, will be sales manager.

The Ohio Metal Company, Columbus, Ohio, will soon commence work on an addition to its plant on North Fourth Street. A small machine shop is in the list of improvements planned.

The McIntyre Mfg. Company, Columbus, Ohio, maker of internal combustion engines, is preparing to put on the market a medium-priced farm tractor, and will probably increase the capacity of its plant.

The Solar Metal Products Company, Columbus, Ohio, manufacturer of metal windows, doors, specialties, etc., has had plans prepared for an addition to its plant on Cleveland Avenue.

The American Mechanical Toy Company, Dayton, Ohio, has secured more commodious quarters and will soon increase the capacity of its plant.

The Rath Metal Products Company, Chillicothe, Ohio, is contemplating an addition to its plant. No details are yet available.

Detroit

DETROIT, MICH., Dec. 27, 1915.

The A. T. Harrow Company, Detroit, has been incorporated with a capital stock of \$400,000 to manufacture motor tractors. Plans are now being considered. Among the promoters are A. T. Harrow, H. M. Sweet and Edward A. Cobo.

The Premier Cushion Spring Company, Detroit, has been organized with \$25,000 capital stock by William D. McCullough, William A. Falls and Joseph A. Schulte to manufacture automobile springs.

The Denby Motor Company, a Delaware corporation with \$750,000 capital stock, has been admitted to Michigan as a foreign corporation. While details are not yet available, this means that there will be a general reorganization and re-financing of the Denby Motor Truck Company, now a Michigan corporation.

The Michigan Arms Company, Detroit, has been incorporated with \$100,000 capital stock to do a general manufacturing business. The incorporators are James W. Peebles, Louis C. Hanley and Frank Q. Bayles.

The Steel Package Company, Detroit, has been incorporated with a capital stock of \$100,000 by Henry C. Wiedeman, Charles Glover and Gustave A. Mueller. It will manufacture steel packages and containers.

The Huff Laboratories, Inc., Detroit, capitalized at \$20,000, has been organized by Orvice LaBounty, Harry L. Cunningham and Edward S. Huff to manufacture gasoline and electric engines and appliances.

The Russel Motor Axle Company, North Detroit, Mich., has increased its capital stock from \$50,000 to \$250,000.

The Reo Motor Car Company, Lansing, Mich., has increased its capital stock from \$400,000 to \$1,000,000. A number of additions to its plant are in course of construction.

The Goodale Company, Kalamazoo, Mich., manufacturer of aluminum ware and castings, has increased its capital stock from \$10,000 to \$60,000. It has had plans prepared for a factory which will be erected.

The Columbia Truck & Trailer Company, Pontiac, Mich., manufacturer of motor trailers, has awarded the contract for an additional building, 60 x 250 ft.

The Detroit Auto Products Company, Detroit, has been incorporated with \$50,000 capital stock to manufacture automobile parts and accessories. Joseph Eugene and Leo Siegel are stockholders.

The Commerce Motor Car Company, Detroit, manufacturer of auto trucks, has increased its capital stock from \$100,000 to \$200,000.

The Gier & Dail Mfg. Company, Lansing, Mich., has increased its capital stock from \$100,000 to \$500,000 and will erect a factory and install additional equipment. It manufactures both light and heavy stampings and pressed steel automobile parts. W. K. Prudden is president.

The Briscoe Motor Company, Jackson, Mich., has been re-organized with a capital stock of \$6,000,000 and has acquired the business and plants of the Mason Motor Car Company, Waterloo, Iowa, the Jackson Motor Parts Company and the Jackson Metal Products Company. It has also acquired the real estate holdings of the Lewis Spring & Axle Company.

The Grand Rapids Varnish Company, Grand Rapids, Mich., capitalized at \$50,000, has been organized by Wallace E. Brown, Robert L. Johnson and George H. Brown. It is negotiating for a factory.

The Menominee Electric Mfg. Company, Menominee, Mich., has increased its capital stock from \$60,000 to \$100,000 to provide for extensions of its facilities. New equipment and machinery for the manufacture of motors, telephone and electric goods will be purchased at once. Henry Tideman is president and general manager.

The Central South

LOUISVILLE, KY., Dec. 27, 1915.

Machinery houses report the year closing in good shape, and prospects for immediate business good. Supply houses do not seem to be getting as much of a call for goods as machinery companies. The market for transmission equipment and power-plant supplies is dull. Boilers are selling well, and motor-driven machine tools are another active line. Special equipment is in demand, and with the large increase in construction work now in prospect it is expected that power plants for contractors will be largely needed.

The Jenkins Lubricating Company has been organized in Louisville with \$325,000 capital stock to make greases. Warner Jones, Paul Jones & Co., has detailed information.

The Kentucky Wagon Mfg. Company, Louisville, manufacturer of farm wagons and implements, is planning to equip for the manufacture of automobiles. R. V. Board is president.

The Federal Chemical Company, Louisville, has increased its capitalization from \$4,000,000 to \$4,500,000 and will establish a fertilizer plant in Indiana. Details are not yet available.

The United Gas & Fuel Company, Ashland, Ky., has plans for the establishment of a plant for the purification of oils and the manufacture of gasoline and by-products to cost about \$100,000.

The Pikeville Planing Mill & Supply Company, Pikeville, Ky., will install equipment for the manufacture of flooring. It is also enlarging its power plant.

W. D. Dickinson and others have purchased control of the Glasgow Water Company, Glasgow, Ky., and are planning improvements.

The Tennessee Stove Works, Chattanooga, Tenn., will be enlarged by a new building, and additional equipment costing \$40,000 is in prospect. J. L. Caldwell is president.

The Thatcher Spinning Company, Chattanooga, Tenn., has purchased a site 180 x 424 ft. for its new mill to be erected and equipped at a cost of \$250,000. Herbert Thatcher is in charge.

The grain elevator of Logan & Co., Nashville, Tenn., was burned recently with a loss of \$70,000. Plans for rebuilding are being considered.

The Tennessee Extract Company, Nashville, Tenn., has been organized with \$300,000 capital stock to manufacture tannic acid. A 22-acre site in West Nashville had been secured, and a plant will be built at once.

Sharon, Tenn., will issue \$25,000 of bonds for an electric light plant and waterworks.

The Columbian Iron Works, Chattanooga, Tenn., has secured a large order for shrapnel from the agent of some of the belligerent European nations. It is said to aggregate a million dollars or more. In preparation for turning out the new product, a large building is being erected. This is the first munitions order placed at Chattanooga, although some other industries have received from the Allies much business in more staple lines, such as lumber and harness.

Birmingham

BIRMINGHAM, ALA., Dec. 27, 1915.

The demand for machine tools is especially insistent, and dealers experience great difficulty in having orders filled. Prosperity in agricultural sections is manifesting itself in a disposition on the part of country merchants to purchase large supplies of implements. The outlook is very good.

Robert Campbell, Gadsden, is reported about to resume plans for building a soil-pipe plant.

D. H. Shreve, of the Union Springs Lumber Company, and others, propose to build a peanut-oil mill in Union Springs, Ala.

The Chevrolet Motor Company, Atlanta, Ga., has been incorporated by A. E. Thornton and others, and proposes to establish an assembling plant with a yearly capacity of 15,000 cars. It is reported the plant is to cost \$300,000.

The Florida Brush Company, Tampa, Fla., will incorporate with a capital stock of \$15,000, enlarge its plant and increase the output from 20,000 to 50,000 brushes a month.

St. Louis

ST. LOUIS, MO., Dec. 27, 1915.

Demand for machine tools continues heavy. A sharp shortage is felt of machines suitable for munitions manufacture. Industrially, the St. Louis trade territory is in a very healthy condition, and that portion affected by last year's cotton troubles has recovered completely; in fact, it is really in better financial situation than for many years. Second-hand tools are still in as sharp request as new machinery and practically as hard to get.

The Honnet Gas Appliance Company, St. Louis, Mo., has been incorporated with a capital stock of \$15,000 by N. M. Vaughan, A. M. and V. Honnet.

The Shurnuff Mfg. Company, St. Louis, Mo., has been incorporated with a capital stock of \$12,000 by Thomas M. Taylor, J. P. Parker and J. E. McCarthy to manufacture automobile accessories.

The pressing plant of the East St. Louis Cotton Oil Company, East St. Louis, Ill., has been burned with a loss of about \$55,000.

The Hubbard Woods Lumber & Coal Company, Hubbard Woods, Ill., has been incorporated with a capital stock of \$50,000 by Frank C. Mercer, Joseph D. Mercer and W. H. Campbell.

The McGehee Ice Company, McGehee, Ark., has been incorporated with a capital stock of \$50,000 by C. W. Hollenbaum, H. G. Morley and J. L. Jamison.

The Arkansas Water Company, Little Rock, Ark., has increased its capital stock from \$500,000 to \$2,500,000 to acquire new plants and to install equipment.

The Red Demon Gasoline Company, Muskogee, Okla., E. C. D'Yarmett in charge, is in the market for one 50-hp. and one 250-hp. gas engines, compressor of ice-machine type, etc.

Welch, Okla., will equip a waterworks and an electric light plant under a bond issue of \$32,000. S. M. Booton is city clerk.

The Oil Fields Gas & Electric Company, Tulsa, Okla., has been incorporated with a capital stock of \$200,000 by W. A. Moore and J. T. Lantry and others and will equip gas and electric plants.

The Boynton Refining Company, Boynton, Okla., has been incorporated with a capital stock of \$100,000 by J. B. Ryan and others and will install equipment for a refinery of 1500 bbl. daily capacity.

The Planet Oil Company, Blackwell, Okla., will equip an oil refinery of 1000 bbl. daily capacity. J. J. Brown, Jr., is the engineer in charge.

The Interstate Compress Company, Oklahoma, has completed plans for the re-establishment of its plant recently burned with a loss of \$100,000.

Frank C. Nicholson will equip a brick-making plant with a capacity of 100,000 bricks daily at Henryetta, Okla.

The Fayette Gin & Milling Company, Fayette, Miss., has been incorporated with a capital stock of \$16,000 by local capitalists and will equip a cotton compress and ginnery.

The Crawley Ice Company, Clarksdale, Miss., has been incorporated with a capital stock of \$50,000 by local capitalists and will equip an ice-making plant.

The By-Products Reclaiming Company, New Orleans, La., W. H. Reed, president, will build two large plants. The company has \$500,000 capital.

A machine shop is to be equipped at Monroe, La., by the St. Louis, Iron Mountain & Southern Railroad, under the direction of E. A. Hadley, chief engineer, St. Louis, Mo.

Covington, La., will expend about \$75,000 on a waterworks and sewage disposal system.

Texas

AUSTIN, TEX., Dec. 27, 1915.

The demand for machinery for Mexico is increasing rapidly. It is expected that the recent settlement of revolutionary troubles in Chihuahua will cause heavy shipments of mining and other machinery to that part of the country. The Texas trade is good.

E. A. Fitkin of the banking firm of E. A. Fitkin & Co., New York and Boston, has purchased the plants of the Palestine Water Works Company and the Palestine Ice, Fuel & Gin Company at Palestine, and will install new machinery, etc.

The Freeport Sulphur Company, Freeport, is increasing the boiler capacity of its sulphur-mining plant from 10,000 hp. to 22,000 hp.

The Mission Canal Company, Mission, which was recently sold for \$100,000 to the Bankers' Trust Company, Houston, has been reorganized under the name of the United Irrigation Company, with a capital stock of \$500,000. The incorporators are John H. Shary, H. A. Shannon and D. W. Glascock. The irrigation pumping plant and canal system will be enlarged.

It is reported that the International & Great Northern Railroad Company will begin the construction of shops at San Antonio shortly after Jan. 1. They will cost about \$250,000.

Col. E. P. Thayer, Indianapolis, and associates plan to construct a large water-storage dam and hydroelectric plant on Burro Creek, near Prescott, Ariz.

S. H. Woodruff, Los Angeles, Cal., and associates plan to utilize the underflow of the Gila River near Palomas, Ariz., for irrigation. Pumps, electrically driven, will be installed.

Miami, Ariz., voted \$80,000 bonds for the construction of a municipal waterworks and \$40,000 bonds for an electric light plant.

The Commercial Club, Orange, has authorized A. H. Prince to purchase machinery for a canning factory.

The cottonseed oil mill of the Southland Cotton Oil Company, Decatur, recently destroyed by fire at a loss of \$80,000, will be rebuilt.

The Pacific Northwest

SEATTLE, Dec. 21, 1915.

The Carstens Packing Company, Spokane, Wash., will erect additions to its Spokane plant at a cost of \$50,000. Thomas Carstens, Tacoma, is president and manager.

J. S. Keen, 2201 South Edison Street, Tacoma, has completed arrangement for leasing the West End Mfg. Company's plant, which will be converted into a chair factory. Machinery costing about \$10,000 will be installed.

Furmon S. Smith and H. M. Mathers, Grants Pass, Ore., have formed a company to manufacture a spark plug.

Permanent arrangements have been completed for the construction of a meat-packing plant in Billings, Mont., by the Yellowstone Packing Company, recently incorporated for \$400,000 by J. B. Henderson, Chinook, Mont.; J. E. Jurtz and J. G. Herd, Billings; Gus Thompson, Hardin, Mont., and M. W. Cromer, Laurel, Mont., who will act as a board of directors. The company plans a slaughter house, ice plant, water plant and cold storage and refrigerator plant.

The Columbia Fireworks Company, Portland, Ore., has leased a site in Portland, on which it will erect a factory for the manufacture of fire works. The plant will employ about twenty or thirty people.

The Beaver Motor Car Company, Gresham, Ore., will construct an addition to its factory, 32 x 70 ft., to be used as a foundry. It will be equipped with the latest type of machinery.

The Woodworth Mfg. Company, Seattle, has been incorporated for \$75,000 by W. N. Woodworth and J. B. Woodworth. It plans a factory for the manufacture of novelties.

The Green Machinery & Mfg. Company, Salt Lake City, Utah, will build a warehouse and factory at 570 West Eighth Street, South, to provide more room for its manufacture of mining machinery, concrete mixers, etc.

The Loggers & Contractors Machinery Company, Portland, Ore., has moved its office from 71 Fifth Street to 70 Fourth Street.

Canada

TORONTO, Dec. 27, 1915.

The Goodyear Tire & Rubber Company, Akron, Ohio, is contemplating the erection of a plant at New Toronto, Ont., to cost about \$1,000,000.

The Canadian Cottons, Ltd., is erecting a plant at Marysville, N. B., and will purchase generator equipment to consist of a 62½-kw. direct-connected to a vertical engine.

The Canadian Cartridge Company, Hamilton, Ont., will erect an addition to its plant and will be in the market for considerable equipment.

Mutchenbacher Brothers, Mafeking, Ont., will rebuild their sawmill recently destroyed by fire. It will cost \$20,000.

The Monarch Machine Tool Company, Hamilton, Ont., is about to occupy the factory at Young and Ferguson streets, and will make alterations and additions to it.

Grande Mere, Que., is receiving bids until Jan. 5 for electrical equipment, including one 500-hp. turbine, one generator with exciters, six transformers, etc. Louis Berube is secretary.

The West Lorne Motors, Ltd., West Lorne, Ont., will establish a plant to manufacture gasoline tractors, etc.

David Eldt, Hanover, Ont., is in the market for a gasoline engine of from 10 to 20 hp.

Wright & Co., 30 Mutual Street, Toronto, is in the market for an electro-plating dynamo.

The Rapid Motor Company, Ltd., Montreal, has been incorporated with a capital stock of \$20,000 by E. Pinsonneault, George A. McGowan, J. O. DeVaux and others to manufacture automobiles, etc.

The P. N. Trahan, Ltd., Montreal, has been incorporated with a capital stock of \$20,000 by Pierre N. Trahan, Thomas Ducharme and others to manufacture cement blocks, bricks, etc.

J. E. Gardner, 10 Morrison Street, Niagara Falls, Ont., is in the market for one internal combustion engine of 50 hp. or over for a sawmill.

The ratepayers of West Lorne, Ont., voted to grant \$80,000 for a plant to distribute electric power.

The Canadian Steel & Brass Products, Ltd., Toronto, has been incorporated with a capital stock of \$500,000 by Arlington T. Bowlby, 23 Toronto Street; Richard G. McClelland, Albert Ogden and others to manufacture war munitions, tools, agricultural implements, etc.

The Electro Welding Company of Toronto, Ltd., Toronto, has been incorporated with a capital stock of \$40,000 by William H. Irving, 10 Adelaide Street East; Henry H. Davis, John R. Rumball and others to manufacture structural steel, machinery, tools, etc.

The George McAllister & Sons, Ltd., Guelph, Ont., has been incorporated with a capital stock of \$40,000 by John A. and George McAllister and others to manufacture articles from wood, operate sawmills, etc.

The Lindsay Woodworkers, Ltd., Lindsay, Ont., has been incorporated with a capital stock of \$40,000 by James A. Peel, Robert A. Pogue, John F. Maunder and others to manufacture furniture, iron, steel and other metals, etc.

The G. H. Tod Company, Ltd., Toronto, has been incorporated with a capital stock of \$40,000 by Charles W. Kerr, 710 Lumsden Building, Toronto; George H. Tod, Bruce E. Ingham and others to manufacture metals, machinery, tools, wire, etc.

The Canadian Electrode Company, Ltd., Montreal, has been incorporated with a capital stock of \$100,000 by Howard Murray, William S. Hart, John C. Smith and others to manufacture metals, furnaces, cupolas, machinery, tools, etc.

The Three-O-System Company, Ltd., Toronto, has been incorporated with a capital stock of \$250,000 by Fred H. Barlow, 12 Richmond Street East, Toronto, and others to manufacture furnaces, stoves, boilers, etc.

Government Purchases

WASHINGTON, D. C., Dec. 27, 1915.

The United States Engineer Office, Wheeling, W. Va., will receive sealed proposals until 11 a. m., Jan. 22, for construction of powerhouses Nos. 16 and 17, Ohio River.

The general purchasing officer of the Panama Canal, Washington, will receive sealed proposals until Jan. 29 under File R-2168-H for furnishing one motor-driven polishing, buffing and grinding machine.

Bids will be received* by the Bureau of Supplies & Accounts, Navy Department, Washington, schedule 9158, for 54 portable electric drills for Brooklyn.

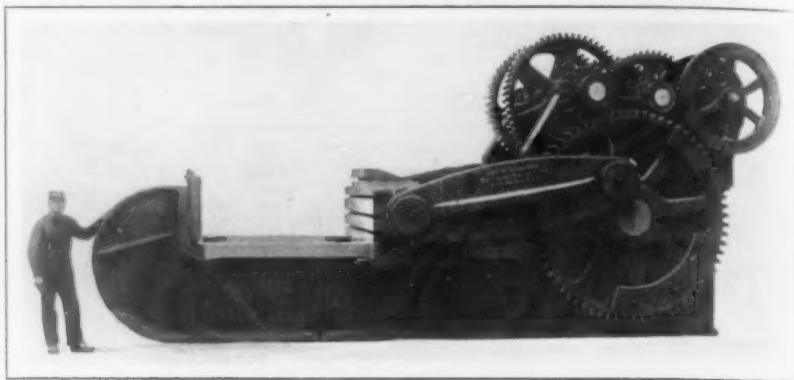
*No date set for receiving bids.

Bulldozer Exerting 500 Tons Pressure

A bulldozer, which is claimed to be capable of exerting a pressure 50 per cent greater than any machine formerly built, has been designed by Williams, White & Co., Moline, Ill. It is being used for forging shrapnel and high-explosive shells, distributed pressure of 500 tons being exerted for this purpose.

The gears and pinions are made of steel with cut teeth, and the main bed and the side arms are steel castings. A large steel shaft is fitted through the sliding casting, the ends of which serve as trunnions. A 75-hp. motor, mounted on a bracket bolted to the housings, supplies the power through cut gears. The machine has forward and reverse movement controlled by friction clutches. The crosshead and ways have T-slots and the end lugs are provided with taper gibs in place of the customary screws for adjusting the dies.

Some idea of the size of the machine can be gathered from the accompanying illustration showing a man at one end of the bulldozer and the fact that the floor space occupied is 12 ft. wide and 26 ft. long.



Bulldozer for Forging Shrapnel and High -Explosive Shells, Capable of Exerting a Pressure of 500 Tons

Bench Milling Machine for Small Parts

The Bickett Machine & Mfg. Company, Cincinnati, Ohio, has designed a new bench milling machine, especially adapted for splining and milling small parts at a high speed. This machine is claimed to be especially useful in finishing parts of rifles, revolvers, automatic weighing machines, typewriters, etc.

The spindle is made of high-carbon steel, ground all over and mounted in ball bearings that are provided with dustproof covers. All sliding bearings are wide and have gibs that are adjustable to compensate for wear. Cone pulleys with a 2¼-in. face and steps ranging from 3 to 6 in. in diameter, driven from two countershaft pulleys 2¼ in. and 6 in. in diameter, giving spindle speeds ranging from 100 to 1200 r. p. m.

The table is 3¾ x 13 in., and the table cross feed in line with the spindle is 3 in., with a longitudinal feed of 6½ in. The vertical adjustment of the knee is



Bench Machine for High-Speed Splining and Milling of Small Parts

5 in., and the T-slots have a width of ½ in. Adjustable stops for both the table and the knee form a part of the machine's equipment.

The machine is compactly built, with a base of 9½ x 18 in., and the total weight on the column is 275 lb.

Heavy Damages on Unfilled Machine Contract

The Kentucky Court of Appeals has affirmed a judgment of \$91,585 against the Noyes Mfg. Company, Columbus, Ohio, and the United States Fidelity & Guaranty Company, its surety, in favor of the Travelers' Insurance Machine Company, Louisville, Ky. The case has attracted much attention in machinery circles. The Travelers' Insurance Machine Company patented a machine to sell accident insurance by a coin-in-the-slot arrangement, and contracted with the Noyes Company to make 500 machines, the terms including a time limit and requiring that the machines be in perfect operating condition. The Guaranty Company gave bond to the Insurance Machine Company for the performance of the contract. The plaintiff in the case alleged that only 132 machines were delivered, also that a number of those were defective, and on this basis asked for damages, which were awarded. It is said that the Guaranty Company will not lose, as it is protected by collateral deposited by the Noyes Company.

With a view to benefiting by the Interstate Commerce Commission's decision in its favor last March relative to interchange of freight between its boats and railroad lines west of the Ohio River, the Chattanooga Packet Company has purchased additional river craft so as give a double service between Chattanooga and Ohio River points. Anticipating the increased tonnage to be handled at the Chattanooga wharf the city commission was asked to put it in condition for moving freight to and from the boats at the minimum cost per ton. Competent river engineers were asked to furnish a plan for terminals that will meet the needs not only of the present, but take care of the future ten or fifteen years. The one that seems to be most in favor is furnished by a Chattanooga architect, J. D. Alsup, embracing an electrically controlled movable platform operating between the warehouse and the railroad track and boats at anchor at the wharf.

The European war has caused a famine in searchlights in this country, especially those of high power. The situation was revealed during Electric Prosperity Week. Cities in the Central West, which were endeavoring to get them for special illuminations, applied as a last resort to the Panama-Pacific Exposition and received word that, three weeks before, twelve big searchlights had been shipped thence to Europe.

The Canadian Car & Foundry Company, Montreal, has received an order from the Imperial Oil Company for 100 40-ton tank cars; another from the Michigan Central Railroad for the steel underframes of 150 50-ton flat cars, and another for 100 20-ton, end-tipping coal cars for use on the Nigerian Railroad, in Africa.

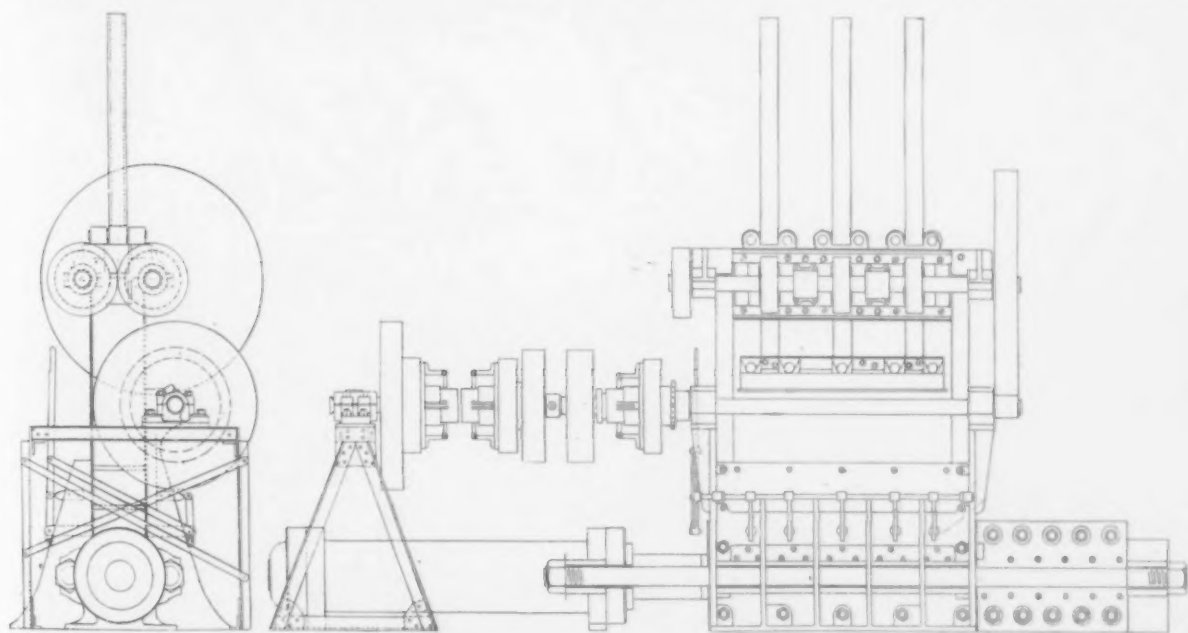
Hydraulic Scrap Compressing Machine

The Tempus Reclaiming & Mfg. Company, 25 North Seventh Street, Philadelphia, Pa., has added another machine to the line of scrap presses it builds. This new machine is like the one which was illustrated in THE IRON AGE, May 13, 1915, in being stationary, but it differs both as to the method of operation and also the shape of the product. It will be recalled that the earlier machine produced cylindrical bundles by rolling, while the press illustrated produces bales of square cross-section by pressure on the top and at one end. Like the stationary machine, and also the portable one, which was illustrated in THE IRON AGE, Nov. 26, 1914, the machine takes light sheet metal, tangled wire, bushy turnings, etc., and compresses them into a bale for shipment to a puddling furnace or detinning plant. Both mechanical and hydraulic power are used in operating the machine.

The main frame is built of cast iron and steel and the interior, which is subjected to wear, is

this way it is possible to bale tin scrap, which is to be taken apart for detinning, loosely for shipping purposes, or melting stock, it is emphasized, can be made practically solid, the movements of the two rams binding the material together. As the delivery of the bundles is continuous and against a pressure, they can be fed into an adjustable chute that will deliver to a pile or directly into the car in which the material is to be shipped.

The press proper requires a floor space measuring 4 x 16 ft. and weighs 22,000 lb. The pump weighs 6500 lb. and requires a space measuring approximately 6 x 9 ft. The floor space occupied by the accumulator is a square measuring 66 in. on a side and the weight of this part is 10,000 lb. The vertical ram requires approximately 10 hp. and the power consumption of the hydraulic pump is approximately 28 hp., the power in both cases being supplied either by a belt or a direct-connected motor. The hourly capacity of the press is from 20 to 30 bundles or from 2 to 3 tons, the variation in the



A Scrap Compressing Machine in Which the Billet or Bundle of Scrap Is Formed by a Combination of a Belt-Driven Ram and One Operated by Hydraulic Power

lined with steel plates. The gears and racks are cut from solid blanks. The hydraulic pump is of the horizontal geared four-piston type, built for a pressure of 3000 lb. An automatic trip and governing valve are provided and the operating valve is of the balanced-piston type, 1½ in. in diameter. The hydraulic cylinder is a steel casting lined with a bronze composition and the piston and piston rod are a single piece of forged steel. The accumulator has a machinery steel ram 5½ in. in diameter and a cast steel cylinder. The counterweight tank is 63 in. in diameter and 126 in. high. Boiler plate is used in its construction and approximately 75,000 lb. of scrap material, such as small hard turnings or iron ore, is required for balancing purposes.

In operation the material is placed in the pressure box, which is 12 in. wide, 30 in. deep and 48 in. long, through a chute at the back of the press. The ram, which is fed by a set of racks and pinions, driven by a friction clutch, compresses the material into a bale 12 in. square and 48 in. long. When this has been done the ram is locked and hydraulic pressure is applied. This exerts a pressure of 200 tons on the side of the mass and forces it into a friction box at the right of the press. The resistance in this box can be varied according to the density it is desired to give the product. In

amount of output being due to the skill of the operator, the character of the material being handled and the convenience of the arrangements for feeding.

The Pittsburgh Foundrymen's Association

The monthly meeting of the Pittsburgh Foundrymen's Association was held in the Fort Pitt Hotel in that city on the evening of Dec. 20. About 150 were present, it being the largest meeting of the association ever held. The Gibb Instrument Company, Highland Building, Pittsburgh, and Emil Schwind, Butler Car Wheel Company, Butler, Pa., were elected members. Dinner was served, after which there was a social entertainment. F. H. Zimmers, secretary, took the character of Santa Claus, and distributed gifts from a Christmas tree to present and past officials and others prominent in the work of the association. The campaign for 50 new members is being pushed and the association expects to increase its membership materially.

The Chattanooga Gas & Coal Products Company, Chattanooga, Tenn., operating a battery of Roberts by-products ovens, announces that facilities for coke making and developing by-products will be largely increased at once.

NEW TRADE PUBLICATIONS.

Detachable Belt Couplings.—Stewart & Co., 171 Broadway, New York. Circular. Concerned with a detachable belt coupling for flat belts. Illustrations of the coupling are included, together with directions for its attachment and a list of the sizes in which it can be supplied. Mention is also made of a drawn steel coupling for round belts.

Speed Transformer.—Turbo-Gear Company, Industrial Building, Baltimore, Md. Catalog A. Gives a brief description of the application and design of the Turbo-Gear for transforming the speed of the prime mover to that of the driven apparatus. A description of this device, which consists of a large internal double helical steel gear and a double helical steel pinion with intermediate bronze gears, appeared in THE IRON AGE, July 29, 1915. A table of the horsepower transmitted by the device at various speeds and speed ratios is included.

Washed Air.—American Blower Company, Detroit, Mich. Pamphlet entitled "The Commercial Value of Washed Air." Calls attention to the advantages to be derived from the use of the company's air-conditioning system by which the humidity can be kept at any desired point. A brief historical account is given, followed by a discussion of what the apparatus is designed to do and the way in which the results are secured. A number of illustrations of buildings in which the apparatus is installed are presented, together with engravings of the different parts of the system. Capacity tables for various sizes of apparatus are included.

Triplex Plunger Pumps.—Scranton Pump Company, Scranton, Pa. Bulletin No. 105. Deals with a line of triplex plunger pumps of the horizontal divided water end type which are built in both horizontal and vertical styles. A brief description of the pumps which are designed for medium lifts up to a 350-ft. head is presented, the text being supplemented by numerous engravings of the various parts. A table of the several sizes that are built is presented, together with a diagram of one of the pumps driven by an electric motor through a single reduction gear, and a numbered list of repair parts is included.

Wiring Devices.—Bryant Electric Company, Bridgeport, Conn. Catalog No. 5. Size, 8 x 10½ in.; pages, 168. This is the company's 1916 catalog describing, chiefly by illustrations, an extensive line of wiring devices, which includes switches, sockets, receptacles, etc. A diagram for calculating the drop in feeders of various sizes is presented, together with wiring diagrams for various switches and a list of devices that are suitable for concealed and conduit box work. An index to catalog numbers and an alphabetical index are included.

Flexible Armored Electrical Conductor.—Western Conduit Company, Youngstown, Ohio. Pamphlet. Points out the advantages of using Realflex armored conductor for wiring old and new buildings. A number of views showing how this conductor, which consists of the wires protected by insulation and a flexible steel wire armor, is used are included. The price list of the various sizes and styles of conductor that can be supplied is given.

Iron Bars and Shapes.—Logan Iron & Steel Company, Burnham, Pa. Folder. Lists the various sizes of square-edge flat, round, half-round, square, oval, half-oval and hexagon bars and angles, channels and boat and fender irons that are regularly rolled. A list of the extra charges for various sizes and quantities is included.

Alternating-Current Generators.—Allis-Chalmers Mfg. Company, Milwaukee, Wis. Bulletin No. 1075-A. Illustrates and describes a line of alternating-current generators designed for belt connection to an engine, waterwheel or line-shaft. Views of various parts of the generators are employed together with engravings of the different sizes to supplement the text description.

Engine Lathes.—Oliver Machinery Company, Grand Rapids, Mich. Circular. Devoted to a 16-in. heavy-duty engine lathe in which the columns are placed so as to eliminate overhang at the ends of the bed, and are made wide with a view to reducing the span of the bed between them. A complete description of the lathe is presented, supplemented by two views of the machine and a table of specifications.

Ball Bearings.—New Departure Mfg. Company, Bristol, Conn. Pamphlet entitled "Ball Bearings in Commercial Applications." Is a comprehensive exposition defining the many practical uses of anti-friction bearings of the ball type in all parts of the mechanism of self-propelled vehicles designed for the severe requirements of industrial service. Although the book has been issued by a manufacturer of ball bearings

and though the applications of some of its products are illustrated, at the same time the bulk of the book is a discussion of applications of ball bearings to various forms and types of modern mechanism without specific and definite reference to any particular company's products. Among the applications discussed are motor trucks, internal combustion engine crankshafts, power plant auxiliaries, agricultural and industrial tractors, street railway cars, etc. A brief description of the plant where these bearings are made and the methods by which they are produced are included.

Divided Machine Vises.—Schuchardt & Schutte, 90 West Street, New York City. Circular. Calls attention to a divided machine vise for use on the tables of planing, milling, shaping, drilling and slotting machines as a substitute for the ordinary parallel vise. The special features of the vise are ability to clamp long or irregularly-shaped pieces and the ease with which it is possible to adjust the vise for different lengths and sizes of work. Illustrations of the vise in use on machine tables supplement the text description and a table of specifications is included.

Calendar.—L. S. Winne & Co., Kingston, N. Y. Desk calendar. Size, 6¼ x 6¾ in. The pad, which occupies practically all of the calendar, contains on each leaf the days for one week printed in large white figures on a black background. The name of the month appears at the top of the leaf in black on a white background, while the names of the days of the week are in white on a red strip.

Ball Bearings.—Norma Company of America, 1790 Broadway, New York City. Catalog No. 105. Embodies a brief description of the essential features of the company's bearings with a short analysis of the principles of anti-friction efficiency and tabular data on the various bearings that can be supplied. The description of the bearings is supplemented by numerous engravings of various features, as is also the discussion of the efficiency of the bearings. A number of drawings showing applications of the bearings are included, together with some suggestions on the selection of bearings.

Twist Drills and Reamers.—Whitman & Barnes Mfg. Company, Akron, Ohio. Calendar hanger measuring 13¼ x 19 in. The pad which measures approximately half the size of the hanger contains a calendar for the current month in large block figures, each day being separated by rules of a contrasting color, while the days of the present and the succeeding month are printed in smaller but none the less legible figures. A reference to some one of the company's products is given at the bottom of each leaf and there are a number of illustrations of different ones on the back.

Leather Belting.—Charles A. Schieren Company, New York City. Calendar. The body of the calendar contains a reproduction of a roll of leather belting with the head of a bull in the center. The calendar pad occupies only a small part of the whole but the block figures used are easily read.

Lathe.—Fairbanks, Morse & Co., Inc., 30 Church Street, New York City. Circular. Describes briefly and illustrates a heavy standard lathe, designed particularly for turning and boring projectiles ranging from 3 to 6 in. in diameter. The various features of the tool are touched upon in this description, which is supplemented by a condensed table of specifications. An illustrated description of the lathe appeared in THE IRON AGE, Aug. 5, 1915.

Boiler Settings.—Houston, Stanwood & Gamble Company, Cincinnati, Ohio. Bulletin No. 261. Shows a number of steel plate settings for boilers with either overhanging or flush fronts or a Dutch oven furnace. There is no text in the bulletin, reliance being placed upon the engravings to tell the story.

Pivoted Bucket Conveyor.—C. W. Hunt Company, Inc., West New Brighton, N. Y. Catalog B-15-4. Size, 6 x 9 in.; pages, 51. Contains specifications of the company's pivoted bucket conveyor with drawings giving details for the use of an engineer in laying out a boiler house. Mention is made of a coal cracker and cut-off valve and there are a number of illustrations and drawings showing up-to-date practice in handling coal, ashes, coke, cement clinker, etc.

Electric Arc Welding.—Lincoln Electric Company, East Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio. Pamphlet. Pertains to the electric arc welding process and discusses the principles underlying arc welding practice. This is supplemented by a number of views of the process. The equipment required is briefly described and mention is made of a number of applications of the process with illustrations showing the parts that have been repaired in this way. A machine in which the controlling panel board is situated adjacent to the machine is illustrated and briefly described. An illustrated description of this machine appeared in THE IRON AGE, Aug. 5, 1915.

Calendar.—J. P. Knight & Son, Columbus, Ga., has issued a calendar hanger measuring 15 x 27 in. It is remarkably free from advertising and has a pad with easily read figures for the days of the months, followed by small numerals indicating the number of days that have elapsed.

